INTERNAL DERANGEMENTS OF THE KNEE-JOINT IN MILITARY PRACTICE: WITH SPECIAL REFERENCE TO LESIONS OF THE MENISCI.

by

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"Osborne House, in the Isle of Wight, has, since 1904, been a convalescent home for officers of both - or all three - Services. In days before the war, cases of battle-damage were in the minority; for, prosaic though it be, more than half the patients were suffering from either damaged knees (the knee being an infernally tricky joint) or from appendices present or recently absent in the wave of appendicomania which swept the land in the decade before the war."

Blackwood's Magazine,

May 1928.

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FIGS. 1 to 81.

I. INTRODUCTION.

In these post-war days the knee-joint continues to present to the military surgeon one of his most frequent and important problems. After parades officers and men seek relaxation in games; and in these games, particularly in football, the knee-joint frequently comes to grief. It has been stated by a surgeon of very extensive experience that football players are, next to coal-miners, the most frequent sufferers from torn semilunar cartilage.[1] Operations for internal derangement of the knee-joint are amongst the first half dozen major operations most frequently performed by military surgeons.

In recent years the Director, Army Medical Service, in his annual reports on the health of the Army, has initiated the useful custom of making brief comments on the various common diseases which have given rise to disability and admission to hospital during the year under consideration. These comments are based on the mass of statistics at his disposal and on the annual reports of the various specialists throughout the Army. Those comments relating to internal derangement of the knee-joint are now to be quoted as affording an indication of the frequency of this condition and its treatment in the Army.

REPORT ON THE HEALTH OF THE ARMY (BRITISH) FOR THE YEAR 1923. VOL. 59: PUBLISHED 1925, H.M. STATIONARY OFFICE.

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Operations for the relief of this condition are of great importance in the Army, as among a body of athletic young men the disability is increasingly common, and the inefficiency resulting from it is great. To be really successful, the operation for removal of the displaced or damaged cartilage must be carried out before repeated attacks have so weakened and stretched the ligaments of the joint as to make recovery after operation a tedious and doubtful matter. Scientific massage and electrical treatment to maintain function in the thigh muscles has done much to hasten the recovery of these cases after operation. Manipulative replacement of a displaced intraarticular cartilage, while a useful method in civil life, has not the same value for the soldier, who when he returns to work, must take part in all the duties and games of his comrades, and recurrence of the trouble is only too likely. As already pointed out, several recurrences cause damage to the whole structure of the joint, so that at this stage operation often gives disappointing results. Early

open/

open operation in all definitely diagnosed cases is the correct treatment for the soldier.

There are no figures with which to compare the number of operations in earlier years, but during 1923 there are records of 136 operations for removal of intra-articular or loose cartilages from joints. With regard to the method of operation, it has been found that the simpler methods of approach, with due regard to the important ligaments of the joint, have given better results than the wide exposures recommended by some authorities."

REPORT ON THE HEALTH OF THE ARMY (BRITISH) FOR THE YEAR 1924. VOL. 60: PUBLISHED 1926, H.M. STATIONARY OFFICE.

"INTERNAL DERANGEMENT OF THE KNEE-JOINT.

There were 216 admissions for subluxation of intra-articular cartilage, and 13 were discharged as unfit for further service. Careful observation of disabilities of the knee-joint point to the fact that recurring attacks of synovitis on slight provocation are often accounted for by an internal derangement quite apart from the cases where definite locking of the joint occurs. Early diagnosis of such cases and operation/

operation for the removal of the offending structures have resulted in a permanent cure in most cases, and it is anticipated that frequent admissions for attacks of synovitis will consequently decrease."

REPORT ON THE HEALTH OF THE ARMY (BRITISH) FOR THE YEAR 1925. VOL. 61: PUBLISHED 1927, H.M. STATIONARY OFFICE.

"INTERNAL DERANGEMENT OF THE KNEE-JOINT.

During the year 254 cases diagnosed as Internal Derangement of joints were admitted to hospital and 20 cases were discharged as invalids on this account. The largest proportion of these cases were definite displacements of or damage to the intra-articular cartilages, and the results of operation have been very satisfactory when carried out before repeated attacks have seriously damaged the joint.

Of the 254 cases 223 returned to duty and 11 remained in hospital at the end of the year.

Reduction by manipulation of a displaced semi-lunar cartilage in the knee-joint is constantly and successfully carried out by army surgeons. It is the usual practice to treat all such cases presenting themselves for the first time with a locked knee by manipulation with complete success. But the experi-

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experience of these cases in the Army shows that even with prolonged rest combined with massage and electrical treatment the disability is liable to recur, for the soldier, unlike the civilian, must continue to follow an active outdoor occupation. A case with a definitely locked joint that cannot be easily replaced by manipulation should be operated on even for a first attack. If several recurrences take place not only is the constantly sick rate of the Army raised but the affected joint becomes more and more damaged and discharge as an invalid is only too likely. Consequently the policy of army surgeons has been to operate on these cases before repeated recurrences have seriously damaged the joint. The dread of operation on the knee-joint is steadily diminishing, and officers and men constantly ask to be operated on in order to continue to play football and engage in other games. The general results of operation are good and only 6 cases who had undergone operation on the knee-joint in previous years required admission to hospital during 1925".

REPORT /

REPORT ON THE HEALTH OF THE ARMY (BRITISH) FOR THE YEAR 1926. VOL. 62: PUBLISHED 1928, H.M. STATIONARY OFFICE.

"INTERNAL DERANGEMENT OF THE KNEE-JOINT.

During the year, 316 cases were admitted to hospital and 20 were discharged as unfit for further service. The admissions show an increase on the previous year when 254 cases were admitted; the discharges remain the same. Of the 316 cases admitted, 104 occurred in India.

Of the 212 cases which occurred elsewhere than in India, 93 had definite symptoms of locking of the joint followed by recurrent attacks of synovitis and were operated upon. In 82 cases the internal semilunar cartilage was found to be displaced or torn and was removed. In 10 cases a similar condition was found in the external semilunar cartilage, which was removed. The remaining case involved both cartilages, which were removed. Of these cases 87 returned to duty and 6 were still in hospital at the end of the year.

Of the 123 cases not operated upon, 100 returned to duty, 3 remained in hospital awaiting operation, the remaining 20 being invalided. Of these 20 cases,

12/

12 had no operation and 8 had been operated upon prior to 1926.

It will be seen from the above figures, that great care is taken in the selection of cases for operation as only 93 cases out of 212 were actually explored, and the operation results have completely justified this selection. No case is submitted to operation until a definite history of locking of the joint has been obtained followed by at least three subsequent attacks of synovitis. It has been found by experience, that if joints are allowed to become distended with fluid more than three times after a cartilage has become torn or displaced, the ligaments become unduly stretched and the case does not respond readily to treatment after removal of the offending cartilage. It subsides gradually into the type of chronic synovitis case which, after spending a greater portion of his service in hospital, has eventually to be invalided."

These comments by the Director, Army Medical Service, are of the nature of guiding sign-posts to the surgical specialists of the Army to whom amongst others they are circulated and on whose reports they are based. We find, accordingly, an initial counsel of early operation for all cases in which a definite diagnosis of injured intra-articular cartilage of the/

the knee has been made, irrespective of whether a history of locking of the joint is present or absent, and, if possible, before any recurrence has taken place; within a period of four years we find this advice replaced by a more cautious counsel demanding a definite history of locking followed by at least three recurrences. We are led to suspect that surgeons following the former policy may have encountered a deterring proportion of negative explorations. If, on the other hand there exist, as stated, atypical cases where damage to an intra-articular knee cartilage is not accompanied by definite locking, but gives rise to recurrent synovial effusions, then the latter policy will exclude such cases from the curative benefit afforded by operation. A middle course of action at once suggests itself as applicable, and in following it we may expect to meet with a certain proportion of negative explorations.

II. MECHANISM OF PRODUCTION OF LESIONS OF THE MENISCI OF THE KNEE-JOINT.

"The accident is usually brought about by a twist given to the leg when the knee-joint is more or less bent, but it may occur, as Walton maintains, even in extreme extension. The effective cause is a twisting of the joint so that the condyles of the femur and tuberosities of the tibia rotate in opposite directions.

The anterior extremity of the internal semilunar cartilage is usually found bruised and torn from its tibial attachment. In the extended position of the knee, displacement is less easy for the cartilages are immovably fixed by the coaptation of the articular surfaces, brought about by the tension of the ligaments and active contraction of the muscles surrounding the joint. When the joint is partly flexed the internal cartilage is fixed (1) by its anterior horn attached to the tibia, above and behind the attachment of the ligamentum patellae and outside the joint cavity; (2) by the transverse ligament to the anterior part of the external cartilage; (3) by the coronary ligament to the capsule of the joint and internal lateral/

lateral ligament; the anterior fibres of this ligament are the longest. As the joint is flexed the cartilages, especially the internal, glide backwards; if now the biceps brings about a sudden rotation outwards of the tibia, the anterior horn is carried forwards and outwards with that bone, while the posterior is firmly fixed to the internal condyle of the femur by the internal lateral ligament, and thus a severe strain is thrown on the anterior part of the internal cartilage.

The same strain occurs when the foot and tibia are fixed and there takes place an inward rotation of the femur, such as occurs at the completion of extension. The weakest point in the internal semilunar cartilage is the thin inner crescentic margin of its anterior third, and it is here that partial rupture usually occurs.

The external semilunar cartilage is smaller than the internal, is rounder, is more movable, and possibly on these accounts is less likely to be 'nipped' between the bones. It is attached in part to the femur through the posterior crucial ligament, and is grooved by the tendon of the popliteus, two factors which add to its security." [2]

"Injuries of the menisci occur in forcible rotation of the flexed or semi-flexed knee. The tibia may be rotated on the femur when the latter is fixed, or the femur may be rotated on the tibia when the/

the tibia is fixed. Statistics show that the medial meniscus suffers injury much more frequently than does the lateral meniscus, and it is probable that the comparative immunity of the lateral meniscus is due to its greater range of movement.

When the tibia is fixed and the femur is suddenly and violently rotated laterally, the lateral meniscus is able to follow the movements of the lateral condyle, and in doing so it exerts a strain on the thin concave margin of the medial meniscus through the transverse ligament. As a result a concentric splitting may occur in the anterior part of the medial meniscus, or its anterior extremity may be torn through and dragged towards the centre of the joint.

In extension of the knee-joint the somewhat flattened distal surface of the medial condyle of the femur is in contact with the whole of the medial meniscus. When the leg is extended, therefore, forcible medial rotation of the femur on the tibia produces little alteration in the shape of the meniscus. On the other hand, when the leg is flexed the more convex posterior surface of the femoral condyle is only in contact with the broader posterior part of the medial meniscus, and in medial rotation of the femur on the tibia the curve of this part is accentuated, while the anterior part becomes correspondingly/

correspondingly straighter. If the violence of the rotatory movement is sufficient to tear its anterior attachment, the meniscus resumes its semilunar outline, with the result that its torn extremity projects into the centre of the joint. Subsequent extension of the joint catches the meniscus between the two articular surfaces." [3]

The diagrams illustrating the above description show two forms of injury of the medial meniscus in accordance with the two theories of their mode of production. In one is depicted a longitudinal fracture of the anterior half of the meniscus commencing at its anterior cornu; the central fragment with the transverse ligament attached to its anterior extremity is shown displaced towards the central joint area. In the other is shown a detachment of the anterior half of the meniscus from the joint capsule and dislocation towards the central joint area of this portion of the meniscus with the attachment of the transverse ligament to its anterior cornu intact. It will be shown later that the former lesion, if it does occur, must be very rare; while the latter lesion probably never does occur.

"A sudden rotation inwards of the femur upon the fixed tibia with the knee partially flexed, combined usually with abduction may act in two ways:

(a) The internal lateral ligament and the attachment/

attachment of the semilunar to its posterior part remain intact, but the attachments of the anterior horn or the weak coronary attachments thereof, or both, are ruptured; the anterior portion of the cartilage itself may be torn; or every variety of transverse or oblique tear may take place opposite the fixed part of the cartilage. The anterior portion of the cartilage is displaced usually towards the interior of the joint, and, its normal elasticity being interfered with, it is often unable to retrace its steps, so that when extension takes place, it is nipped between the inner condyles of the femur and tibia and may be thereby further damaged.

(b) In more severe rotatory movements, the cartilage may be even torn from its attachments to the internal lateral ligament, or if abduction is a marked feature, the latter may be severely stretched or even ruptured. Thus the middle portion of the cartilage may slip into the interior of the joint, and when extension occurs, is apt to be split longitudinally, producing a typical 'bucket-handle' type of lesion.

Probably displacements or splits of the posterior end of the internal semilunar are usually produced in the manner Scott Lang described, by forcible external rotation of the femur upon the fixed tibia combined with flexion. During this movement the posterior/

posterior part of the internal condyle sweeps across the posterior end of the semilunar; then if violent flexion occurs, the latter is liable to be split or detached. Occasionally, external rotation of the femur upon the fixed tibia may cause damage to the anterior horn of the internal semilunar cartilage. This is particularly liable to occur if an accessory band passing from the anterior horn to the anterior crucial ligament be present. For, in such cases, external rotation of the femur is accompanied by a marked traction on the anterior horn. It has been shown experimentally that sudden extension will cause rupture or displacement of the anterior end, and Tenney found that if the leg was forcibly abducted, the upper attachment of the internal lateral ligament was ruptured, and that the posterior part of the internal femoral condyle slipped over the posterior extremity of the semilunar, crumpling it up.

We must, however, apply evidence from the post-mortem room with very great caution to the elucidation of mechanical problems during life; especially when dealing with such a complicated joint as the knee; and a combination of experimental evidence and clinical experience points to the modes already described as the most probable methods of derangement of the internal semilunar cartilage.

Lesions/

Lesions of the external semilunar cartilage are associated with a somewhat severe degree of violence. Displacements of the anterior horn may be produced by external rotation of the femur upon the fixed tibia in the flexed position, or conversely by internal rotation of the tibia upon the fixed femur.

Displacement of the posterior horn of the external semilunar, by no means a rare occurrence, is probably due to internal rotation of the femur upon the fixed tibia followed by or combined with violent flexion. It is one of the causes of a peculiar condition known as 'clicking or snapping knee', the last twenty or thirty degrees of extension being accompanied by a 'click' and a jerk forward of the tibia." [4]

These three quotations represent a body of opinion which attributes the mechanism of the lesions under discussion to rotatory movements of the femur upon the tibia, and vice versa, in the flexed knee-joint: which movements throw strains upon the menisci resulting in indirect traction fractures or detachments of these structures. It is postulated that the majority of lesions are found at the anterior extremity or in the anterior third of the medial meniscus; and this is attributed to fixation of the posterior half of that meniscus in the flexed position of the joint together with undue mobility of its anterior/

anterior half. Inasmuch as both lateral and medial rotation of the femur on the fixed tibia are described as causing lesions of either meniscus it is not clear what is the exact factor which determines which meniscus suffers injury. There is a clearer distinction between lateral and medial rotation movements of the tibia on the fixed femur: the former being said to cause lesions of the medial meniscus, the latter lesions of the lateral meniscus. Timbrell Fisher mentions the possibility of injury produced in extension of the knee; but he tends to discredit the clinical application of experimental evidence in this direction. His statement that the typical bucket-handle lesion of the meniscus is the result of a primary dislocation followed by secondary fracture is, in my opinion, the exact contrary to what actually occurs.

The next authority whom I quote also believes that the flexed position of the knee "in which a certain amount of lateral mobility and rotation is possible" is that which is most conducive to rupture or tear of the semilunar cartilages. He, however, states his belief that "in the large majority of cases definite splitting or tearing occurs, this being brought about by the inner circumference of the cartilage being nipped between the condyles of the femur and the tibia, and then, in consequence of a sudden/

sudden twist, being forcibly dragged towards the centre of the joint." [1] Such a lesion may be classified as a direct traction fracture-dislocation.

Walton in the course of the same discussion[5] renewed his contention, previously formulated, that "injuries of the semilunar cartilages were brought about by a condition of hyperextension of the knee, and not, as is usually taught, by a rotatory movement while the knee is in a position of semi-flexion." He based his argument upon a study of the anatomy and movements of the joint. For him the crux of the matter lay in the twisting movement of the femur on the tibia which occurs at the end of extension. This screw home movement which locks the knee-joint in full extension is usually explained by the fact that the articular surface of the medial condyle of the femur is longer than that of the lateral condyle; and whereas the two condyles are parallel posteriorly the anterior portion of the medial condyle converges towards the lateral condyle. When, therefore, in the movement of extension from acute flexion the articular surfaces on the condyles of the tibia have moved over the full range of the lateral femoral condyle and the corresponding parallel portion of the medial femoral condyle, the further movement which completes the extension occurs in screw fashion between the medial condyle of the tibia and the anterior oblique portion of/

of the medial condyle of the femur. Walton, however, ascribes this twisting movement to the 'couple' action of the two crucial ligaments, which in full extension of the knee rotate the tibia outwards on the femur and at the same time approximate the tibia to the femur. "On extension of the joint, therefore," he writes, "the tibia and femur will be forcibly pulled together. This force, owing to the screw action, will be almost wholly exerted on the inner side and anteriorly." The resulting lesion, occurring in full extension of the knee only, will be a direct compression torsion fracture of the medial meniscus involving its anterior portion.

Finally, in their discussion of internal derangements of the knee-joint Romanis and Mitchiner[6] state dogmatically that injuries to the menisci of the knee-joint are produced by forcible approximation of the articular surfaces of the femur and tibia which squeeze the menisci between them.

The study of the mechanism of production of a traumatic lesion must be closely concerned with two important factors: the history of the accident as given by the patient and the exact nature of the lesion produced. In connection with the former due regard must be paid to the fact that an injury is usually sustained through a sudden and unexpected catastrophe, in the course of which the patient's

thoughts/

thoughts are not likely to be focussed on the exact details of what is happening to him; and, also, that he is very often asked to reconstruct the accident weeks, months or even years after it has occurred with a corresponding liability to inaccuracy in details of his story directly proportionate to the length of time intervening between the accident and his description of it. Hence it is not altogether surprising to find that a review of the histories given by my patients is not very illuminating. But although the history differs in detail in almost every case, there is this common factor present that the trauma has been sustained during the course of some energetic action involving an extra-ordinary strain on the knee-joint, a strain which probably in every case has included the forcible approximation of the articular surfaces of that joint. Thus in 36 cases of proved meniscus damage 23 occurred in the course of games of football, 2 at hockey, 1 at boxing and 2 during hill climbing; while the remaining 8 gave a history of landing more or less heavily on the feet after falling from or sliding down a height. In 5 cases the patients were unable to say more than that they "first put out the knee at football." Nine patients definitely attributed their disability to a "twist of the knee". On the other hand in at least 6 cases the patient thought he could/

could exclude any question of a twist having occurred. In 6 cases the patient attributed his trouble to direct trauma on the knee. Three of these men were kicked on the knee while playing football, one on the front of the knee and one on its antero-lateral aspect, in both of which cases the medial meniscus was found at fault; the third received a kick on the antero-medial aspect of the knee and in this case the lateral meniscus was injured. One man was struck on the antero-medial aspect of his knee by a hockey-ball; one knocked the inner side of his knee against a goal-post at football; and the third lost his balance on board ship and knocked the inner side of his knee against an iron winch. In these three cases the medial meniscus was the site of the lesion. It seems obvious that these injuries in themselves cannot be held to account for the fractures of the menisci found at the operations. Their submission by the patients in explanation of the causation of their knee troubles is an example of the misleading evidence afforded by histories alone. In cross-examining patients I was able to ascertain that although the knee is most commonly flexed to some extent at the time of injury, yet there can be no doubt that the menisci can be damaged while the knee is in full extension.

Turning now to our other concern we find, I think, important evidence in the nature of the lesion in/

in these 36 cases. In the first place, in no case has any meniscus extremity suffered damage. In all cases the anterior cornu with the adjacent portion of meniscus exposed at operation has been found intact; and in those cases where the whole meniscus has been excised the posterior cornu has been found similarly unaffected. Secondly, every specimen is an example of a fracture lesion; and of the 36 specimens 31 are examples of the bucket-handle fracture; there is no instance of pure dislocation involving a detachment of the meniscus from the joint capsule. Fagge has written that "there is only one variety of semilunar injury to which the term 'detached' can be truly applied, and this is the rare lesion of the posterior part of the external semilunar ---------; it was first described by Sir Robert Jones as a snapping knee (genou à ressort)." [7] The menisci are broadly and solidly incorporated at their peripheries with the fibrous structure of the joint capsule; and it is easy to understand and accept that they will yield to trauma through their thinner central portions rather than through their line of attachment to the capsule. Only in the case of the lateral meniscus is this attachment normally broken at one point to allow the passage of the popliteus tendon between the meniscus and capsule at its exit from the joint; and only at this point is it in any way likely that the/

the plane of disruption may extend along the line of capsular attachment from the gap already present. Thirdly, these fracture lesions may be classified according to their site as follows.

1. Lesions confined to the region of the junction of the middle and posterior thirds of the meniscus: 2 cases.
2. Lesions in the region of the junction of the middle and posterior thirds of the meniscus extending into the posterior third: 2 cases.
3. Lesions of the middle third of the meniscus extending into its posterior third: 4 cases.
4. Lesions involving the whole middle third of the meniscus and extending into both its anterior and posterior thirds: 28 cases.

It is clear, therefore, that the portion of meniscus involved in every one of these unselected, successive 36 cases is the region of the junction of its middle and posterior thirds; and it is reasonable to suppose that this has been the starting point of all these meniscus lesions. This theory receives additional support from a further study of the specimens which discovers in no less than 17 of the 31 specimens

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of bucket-handle fracture a secondary lesion consisting of a partial transverse fracture of the dislocating fragment involving its central margin in the region of the junction of the middle and posterior thirds of the meniscus, or just anterior to this point.

If the theory of direct compression fracture is accepted, a glance at a lateral skiagram of the knee-joint will at once afford a complete explanation of this site of election for the origin of the fracture. In the position of full extension of the knee there is the greatest surface contact between the menisci and the somewhat flattened middle thirds of the femoral condyles. (vide fig.1) Owing to the antero-posterior and transverse curvatures of the femoral condyles the extremities of the menisci are well beyond the area of direct contact even in full extension. In this position the body weight is transmitted groundwards through a comparatively broad surfaced bearing at the knee-joint. As soon as flexion commences at the knee the sharply curved posterior projecting portions of the femoral condyles come to bear on the middle thirds of the menisci whose anterior and posterior thirds are now completely outside the range of the possibility of direct compression. In the moderately flexed position of the knee, such as occurs in the acts of running, jumping etc.,/

etc., it will be seen that the curved outlines of the femoral condyles come into close relationship with the practically flat cartilage coated surface of the head of the tibia over a very limited area which is precisely in that region where we believe the majority, if not all, of these lesions have had their origin. (vide fig.2) In this position the body weight, as it passes down through the knee, is concentrated into a comparatively narrow area over which the strain and stress must be correspondingly increased. If, therefore, a meniscus of the knee-joint is subjected to a compression force beyond a certain point, it will yield at the point of maximum compression usually by longitudinal fracture of its substance. Then as, either at the time of the original trauma, or at a later date by further trauma, the central fragment is squeezed by the femoral condyle towards the central joint area the line of fracture is extended by tearing force anteriorly and posteriorly, and so the typical bucket-handle fracture-dislocation lesion is produced. During the stage when the dislocating central fragment is capable of complete reduction it is exposed in its unstable condition to further compression injury either, rarely, in the form of a secondary longitudinal bucket-handle fracture, or, more commonly, in the form of such a transverse fracture as has been described/

described above.

With these arguments it is maintained that the important factor in the production of a lesion of a meniscus is its compression between opposing surfaces of tibia and femur, the exact nature and site of the injury depending partly on the degree of compression and partly on the position of the joint at the time of compression; that lesions may thus be produced both in flexion and in extension of the knee, but more easily and more commonly in the former position; and that the injurious compressing force is not that produced by the sudden and rapid screw action which accompanies full extension of the knee from the flexed position, but is produced by the body weight driving the femur down onto the tibia in certain actions and under certain conditions. The reason for the marked predominance of medial meniscus lesions is to be found in the fact that in the various jumping and turning acts which give rise to the majority of these lesions the body weight is transmitted forcibly earthwards mainly by way of the medial condyle of the femur impacting on the medial condyle of the tibia. For example, if, in the course of running, a rapid turning movement is made towards the left the right lower limb will usually bear the brunt of the strain involved in the turn, and the centre of gravity of/

of the body being shifted towards the side of the turn the body weight will be transmitted mainly through the medial side of the knee.

III. DIAGNOSIS OF LESIONS OF THE MENISCI OF THE KNEE-JOINT.

The operating surgeon rarely sees his case of injured meniscus immediately, or even soon, after the original trauma. Table A gives the interval which elapsed in my 36 cases between the date of injury and the date of operation.

TABLE A.

Interval between date of injury and date of operation.	Number of cases.
12 days	1
22 days	1
28 days	1
52 days	1
3 months	1
4 months	2
9 months	2
11 months	2
1 year	2
1 - 2 years	5
2 - 3 years	6
3 - 4 years	6
4 - 5 years	2
5 - 6 years	1
6 - 7 years	3

Consequently this is one of the conditions in which a clinical history intelligently given and carefully recorded is of invaluable assistance in coming to a conclusion as to the nature of the lesion. "If there be any surgical condition in which a diagnosis can be made from the history alone it is, in my opinion, a torn semilunar cartilage, though I would be the first to admit that to this, which is only a relative truth, there are very many well-marked exceptions." [7] As already explained, the description of the act which is being performed when the injury occurs varies considerably. Commonly at the moment of injury there is a sudden, excruciating pain felt all over the knee, or, perhaps, over its antero-medial or antero-lateral aspect. The man may fall to the ground and find that the affected knee is bent, and he cannot straighten it on account of aggravation of pain produced by any attempt to do so. He may, perhaps, recognise that his knee has 'gone out' and is 'locked'. He may be able to limp or crawl off the field, if he has been playing football; or he is assisted to his feet by comrades and between them hobbles aside. He sits down beside the field and either he or some bystander by practising various manoeuvres on the limb may, or may not be successful in restoring full extension to the joint. The move-

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movements performed usually consist of vigorous pulls on the leg to straighten the knee by sheer force; or of alternate flexion and extension of the knee until it straightens. Often someone will assist by rubbing the knee during these manipulations, which may after all fail to attain their object. After a time the man is able to get back to his quarters. The acute pain quickly subsides and is replaced by aching discomfort in the joint. The patient sleeps well, but awakes next morning to find his knee swollen and reports sick with "water on the knee". He is admitted to hospital; the knee is bandaged over a lead and opium or a Scott's dressing and immobilised on a back splint. When the effusion has subsided massage is instituted and in due course the patient is discharged from hospital to duty. His disease is recorded in the hospital books as "synovitis of the knee."
The history thereafter is that of a succession of similar incidents at varying intervals until operation is advised and undertaken. It is typical that succeeding attacks of disablement become less acute, less severe and less prolonged as time goes by.
The knee tends more and more to 'go out' on slight provocation such as a step and slip on a loose pebble: when swimming, stepping off a pavement curb or down stairs: or merely in rising from a chair or uncrossing a knee. Finally, the patient, having discussed his disability/

disability with others who have, perhaps, been similarly afflicted and successfully operated on, often approaches his doctor with a request for operation on the knee.

TABLE B.

Number of Recurrences of "Locking" or of "Water on the Knee" prior to operation.	Number of Cases.	Approximate Interval between date of original injury and operation.
0	3	12 to 28 days.
1	6	52 days to 13 months
2	1	18 months.
3	4	9 to 14 months; one case 5½ years.
4	1	4 years.
5	1	14 months.
6	2	2 to 4 years.
7 to 10	6	2½ to 6 years.
"more than 10"	2	11 months; and 3 yrs.
"numerous" / "frequent"	10	1 to 7 years.

When the surgeon first sees the patient he may be fortunate to see him soon after a 'locking' incident; or he may see the knee in a perfectly quiescent interval. In the former case there will probably be a point of local tenderness over the line/

line of the affected meniscus, and some degree of synovial effusion into the joint. In the latter case there may be no trace of tenderness or of joint effusion; in such a case a study of the muscular tone and development of the anterior thigh muscles is helpful. If the patient stands erect it may be found that he cannot brace back the affected knee completely; the vastus medialis muscle on the affected side may show definite atrophy and loss of tone as evidenced by its lessened prominence and its softness. It is good practice to measure the circumference of the thigh at two places - immediately proximal to and a hand's breadth proximal to the patella. The former measurement may, on the side of injury, equal the mid-patellar circumference of the affected knee and exceed the corresponding measurement of the other thigh, indicating some degree of swelling of the suprapatellar synovial pouch of the injured knee. The latter measurement is very often less on the affected than on the sound side, indicating some degree of muscular atrophy of the thigh on the side of injury. Timbrell Fisher has described a well marked depression that is visible in some cases in the region of the anterior end of the medial meniscus when the thigh is flexed and rotated inwards on the fixed tibia. I have failed to elicit this sign in any/

any of my cases. The displaced fragment of meniscus is rarely palpable. It was felt in only one case in this series, i.e. Case No.8.

An injury to the lateral meniscus will be indicated by the presence of tenderness localised over some part of the periphery of that structure. Sir James Roberts[8] has pointed out that an injury to the lateral meniscus may give rise to "pain internal to the patella", and that consequently "it is not always the case that external cartilage dislocation can be differentiated from internal." It may be that on this account an exploration of the antero-medial aspect of the knee has been occasionally negative in spite of a fairly certain diagnosis. A symptom particularly, but not exclusively, associated with a lesion of the lateral half of the knee-joint is the occurrence of slipping or clicking in the knee. "One sign is pathognomonic when present, namely a definite click which occurs in the joint on completing full active extension. This click is a very definite and sometimes rather alarming occurrence, and when it is felt with the hands it would seem as if the condyle of the femur had slipped off the spines of the tibia with a definite slip sideways of the joint. Once this definite click and slip produced by a loose external cartilage has been felt by the surgeon, it can never be mistaken for any other/

other lesion, and, in my opinion, it clinches the diagnosis. It has several peculiarities. In its typical form it always occurs in the last few degrees of active extension of the joint, and in my experience it never occurs when a similar amount of extension has been produced passively. By its occurrence only at one particular angle of movement in the joint, and only when such movement is produced actively, it can be readily diagnosed from the loud clicks and snaps which sometimes accompany osteo-arthritic changes in the joint. I have felt on a few occasions a click accompanying movements of the loose internal semilunar cartilage, but here the snap is generally much less definite, there is never the peculiar and definite slip of the two bones on one another, and the snap in each case can be localised by placing the finger or thumb over the particular cartilage affected." [9]

For special use in doubtful and atypical cases M'Murray has described an accessory method of diagnosis which he has found of the greatest help. The affected knee is flexed as completely as possible: the ankle is grasped by one hand and the knee by the other in such a way that the thumb and forefinger grasp the joint on either side behind the fibular and tibial collateral ligaments respectively. "The ankle is now twisted by the right hand so that the knee is rotated inwards/

inwards and outwards to its fullest extent, and if a lesion of the external cartilage or of the posterior portion of the internal cartilage is present a definite click can be felt under the finger or thumb of the left hand. ..... the peculiar sliding or gliding of the femur over an apparent obstacle ..... is ..... typically present when there has been an injury to the external cartilage or posterior portion of the internal." [9]

Finally, in every case an X-ray examination of the joint in the two routine planes must be made. In the vast majority of cases no abnormality will be detected in the skiagrams. Occasionally an unexpected loose body will be revealed and lead to a revision of the diagnosis. To aid in visualising intra-articular derangements the knee-joint has been inflated with oxygen or carbon dioxide gas prior to radiography; but it is doubtful if this refinement is of much practical use; and it is not to be recommended as a routine practice. Wilson and Cochrane mention a faint shadow between the joint surfaces in the skiagrams of the affected as compared with the uninjured knee as being useful in diagnosis.[10] X-rays have, however, given no positive help in my series of cases.

The relative frequency of lesions of the medial and/

and lateral menisci of the knee-joint is variously given by different authors. Table C gives a few of the reported findings. Timbrell Fisher quotes various authorities as giving their experience of lesions of the lateral meniscus at percentage figures varying from 2 to 19. This author himself draws comparison in his cases between an 8 per cent. prevalence of external semilunar lesions in civil cases and a 19 per cent. prevalence of those lesions in war pensioners; and thinks that this difference is probably due to more severe types of injury in the latter cases. Romanis and Mitchiner give the proportion of external cartilage to internal cartilage lesions as one to seventeen, i.e., 5.5 per cent.

TABLE C.

Authority.	Total number of Cases in Series.	Percentage number of lesions of the Lateral Meniscus.
Bennett quoted by Treves and Choyce[2]	200	22.5
Report on the Health of the Army for 1926: Vol.62	94	11.7
Martin [1]	509	7.5
Fagge[7]	19	5.3
Present Series	36	5.5

For the purpose of differential diagnosis the common conditions of the knee-joint to be kept in mind are as follows.

1./

1. Strains of ligaments:
   (a) peri-articular.
   (b) intra-articular.
2. Loose bodies.
3. Nipped exuberant synovial fringes.
4. Fracture of the intercondyloid eminence of the tibia.
5. Peri-articular exostosis.
6. Chronic arthritis.

1. (a) The points of maximum tenderness will be found over the origin of the ligament from the femoral epicondyle or over its insertion into the tibia or fibula. Pain is aggravated by abduction or adduction of the leg. Romanis and Mitchiner state that in cases of traumatic internal derangement of the knee-joint there is nearly always, in the first instance, a sprain of the knee. While the signs of a sprain may undoubtedly be found in a case of damaged meniscus I disagree that it is a necessary preliminary, or even of frequent occurrence.

   (b) Undue antero-posterior mobility of the tibia on the femur may be elicited.

2. Loose bodies in the knee may give rise to painful locking of and effusion into the joint. A point of some significance in the history is the absence of any particular causal trauma to/

to which the patient can attribute his disability. Often the symptoms have appeared insidiously and the patient has some difficulty in estimating their duration accurately; whereas in cases of meniscus lesion the patient can usually date exactly the occasion on which he first 'put out' the knee. On the other hand, where the origin of the symptoms can be traced to a definite injury, this injury is often of a nature which would be quite unlikely to cause meniscus damage according to our theory of its mechanism, e.g., a kick on the knee, a dislocation of the patella, etc. There will be no tenderness over the lines of the menisci; and at some stage in the course of events the loose body as a rule becomes palpable. Skiagrams of the knee are essential and gave positive evidence of the presence of a loose body in six of the nine cases in this series.

3. A nipped and swollen synovial fringe may give rise to typically localised tenderness, but will not cause true locking of the joint. The swollen process may be palpable and may be mistaken for a loose body or a displaced meniscus. Such a mistake had actually been made in one of my cases where the knee was the site of synovial tuberculosis.

4/

4, & 5. Fractures and exostoses will be demonstrated by X-ray examination.

6. Chronic arthritis of the knee may cause some difficulty in diagnosis. In a well marked case crepitation will be palpable and audible on movement of the joint, easily distinguishable from the snap, click or clunk of the genou à ressort. Lipping at the articular margins of the joint may be detected. The condition is often bilateral and occurs in individuals who are usually beyond middle age. Where the condition is secondary to trauma such as an old standing meniscus lesion, the early history of the case and the normal condition of the uninjured knee will be suggestive.

In September 1925 I examined a British soldier aged 28. He had injured his right knee by a 'twist' in 1923. Since then he had had numerous recurrences of trouble with the knee which were treated for 'sprain', 'synovitis', etc. In March 1924 antero-medial arthrotomy was performed elsewhere for 'subluxation of intra-articular cartilage'. No details of the operation were available. He was in hospital on that occasion for 53 days. Since then he has had further recurrences/

recurrences of "water on both knees" with pain on kneeling and shooting pains in the knees alternating with dull aching pain. On examination there was no limitation of movement in either knee. The left knee was tender over the anterior extremity of the medial meniscus. The right knee presented a four inch tender, vertical, antero-medial operation scar. There was slight creaking in the moving knee. Skiagrams showed small osteophytic outgrowths from the margins of the articular surfaces of the tibial condyles of the left knee. The details of the operation findings are unknown, but the symptoms in the right knee have not been relieved by the operation. The case is suggestive of a progressive osteo-arthritis of the knee-joints which in its early unilateral stage mimicked a meniscus lesion.

The condition of snapping or clicking knee has already been discussed. In the reports of my personal cases which follow it will be found that this condition has been met with associated with varying lesions. It only remains to note that it has also been reported as an accompaniment of congenital elongation of the ligamentum patellae.[11]

IV. TREATMENT OF LESIONS OF THE MENISCI OF THE KNEE JOINT.

"A cartilage of the knee-joint becomes ruptured and displaced. The knee cartilages serve as movable bearings to fit together incongruous moving surfaces of the joint. Two courses are open to the surgeon. He may open the joint and stitch the bearings back into their proper position, or, if they are damaged beyond repair, he may remove them and trust to Nature replacing them. But ..... there are surgeons who maintain that as good and as quick healing of the ruptured or displaced cartilages can be obtained by first replacing the fragments by manipulation of the joint. Having thus restored the parts to their right places, they bind the limb to a splint, and leave the actual repairs to Nature. So equal are the results obtained by either of these methods that it is difficult to tell which is the better one. Certainly there are cases of long standing in which repeated and skilled manipulations fail to give relief and which can be set in the way to recovery by a surgical operation." [12]

As we have already seen, the Army surgeon is advised to practise early operation in cases where a diagnosis of injury of a meniscus of the knee-joint has/

has been made, and such operation has been followed by very excellent results. Manipulation and conservative measures have been followed too often by only temporary alleviation and recurrence with resulting loss of efficiency as indicated by a raised 'constantly sick' rate.

Timbrell Fisher states that under favourable circumstances repair occurs in lesions at, or near, the periphery of the menisci; but that repair of lesions of the more feebly nourished central portions of the menisci near the concave edge is very sluggish and may not take place at all. For the former conservative treatment would be reasonably indicated; for the latter probably early operation would give the best results. But, since there is no means of so exactly locating the lesion in the injured joint, he advises in all cases an attempt at accurate reposition of the torn portions of the meniscus by manipulation, the indication of probable success being the removal of any block to full and painless extension of the knee. Reposition is to be followed by immobilisation of the joint for ten to fourteen days; then careful weight bearing and movements are commenced and care is taken to avoid strain on the joint for a further period of several months. Throughout the whole treatment the nutrition of the joint/

joint and its muscles is attended to by massage and later by exercises.

It is obvious that to be successful such conservative treatment must be carried out very soon after the initial trauma has occurred, while the fractured surfaces are still freshly raw. Repair in these surfaces commences at once and unless they are accurately apposed the one to the other the healing will progress independently on each surface until the stage is reached fairly quickly when the reparative processes subside and no amount of contact between the organised surfaces will coax them to unite. A recurrence, especially if it has happened on slight provocation, may be accepted as evidence that a restitutio ad integram is no longer possible. The conservative treatment of such a case consists of massage and exercises and manipulations to rupture or stretch any intra-articular adhesions which may be present. The use of a knee-cage designed to allow only movements of flexion and extension at the knee may prevent further recurrences of locking and effusion, but must be something of a tragedy to the youth condemned to wear it. Over the head of the chronic recurrent case looms the threat of the eventual onset of chronic arthritis. One may therefore conclude that operation is very strongly indicated after the first recurrence of joint trouble.

Against/

Against routine early operation is the possibility of a wrong diagnosis and a negative exploration. Fagge[7] writes that in his experience "operation on an arthritic joint which discloses no causal lesion has been followed by exacerbation of all symptoms, and from the point of view of function and wage-earning capacity has proved a major surgical calamity." In the case outlined above, whether the meniscus was found damaged or not, operation does not seem to have affected the progress of the arthritis. M'Murray[9] deprecates any attempt to draw an analogy between an exploratory laparotomy and an exploratory arthrotomy. The latter, he thinks, is neither justifiable nor necessary; and he found the after-history of several patients in whom this procedure had been adopted at some previous date was almost universally unsatisfactory. However, it would appear that his remarks refer to the long incisions and complete exposures of certain operations which he has found to be followed by a definite thickening of the synovial membrane. In my experience, using the usual short incisions, no ill effects whatever have followed negative exploratory arthrotomies of the knee-joint. Where the diagnosis of an injured meniscus is reasonably certain I am of the opinion that operation is the best treatment in military surgery, whether the case is seen immediately after the original trauma or after/

after many recurrences. I have seen many soldiers who have gone from year to year and from hospital to hospital with weak knees which have prevented them from enjoying their share in the athletic life of their regiments; and I have seen them restored to full activity by operations which would have saved them much semi-invalidism if they had been performed earlier; and, so far as one could gather from their statements and their medical history sheets, they had been treated efficiently by conservative measures in the first instance. I have seen a few cases, practically all of the officer class, where the patient has been satisfied with the result of such conservative treatment; but close inquiry has revealed that the knee is still regarded as weaker than normal and, even many years after the original injury, is guarded against undue strain. The patient may have given up playing games; or, if he does risk playing occasionally, he does so with a bandaged knee and without the normal free, careless activity.

The technique of the operation has been fully developed and described by Sir Robert Jones; and this technique has been largely followed in the operations of this series. The incision is short, obliquely vertical and curved with the concavity directed backwards. Timbrell Fisher recommends a similar/

similar incision commenced proximally further from the patella and curved in the opposite direction. Perhaps this gives a slightly easier and better exposure. The other two incisions which have been recommended for selected cases of complicated or anomalous type are the long incisions of the patella-splitting and the patella-displacing operations; the latter was originated and described by Timbrell Fisher. Sir James Roberts[8] writes that "to split the patella vertically in order to expose the joint is barbarous surgery, as chronic disability is so apt to be left behind." Writing of knee-joint surgery in connection with loose bodies, Harry Platt recommends strongly the adoption of what he describes as compartmental surgery by which each separate joint area is explored as indicated through a short incision suitably placed. Such incisions may be antero-medial, antero-lateral, postero-medial, postero-lateral, suprapatellar and popliteal.[13] There is no doubt that the short anterior incisions of Sir Robert Jones or Timbrell Fisher, supplemented, if necessary, by a short posterior incision as described by Alwyn Smith,[14] should be the incisions of choice in all operations for meniscus lesions. Scarring round the knee-joint should be reduced to a minimum.

Attempts to repair lesions of the menisci by suture/

suture should no longer be practised. A damaged meniscus should be excised. It has generally been considered sufficient to remove as much as possible of the meniscus through an anterior incision. Various writers have expressed their satisfaction with the after-results of this procedure. On the other hand Alwyn Smith[14] has directed attention to a recent tendency to aim at complete removal of the damaged meniscus in all cases, maintaining that post-operative recurrences in a certain proportion of cases have been due to fracture tags or abnormal mobility of the posterior segment of the meniscus where that has been left behind. Romanis and Mitchiner[6] estimate that where the anterior two thirds of a meniscus is excised, in about five per cent of cases the remaining posterior third of the cartilage causes further symptoms. In some cases it is easy to remove the whole meniscus through a short anterior incision; but there are other cases where it is practically impossible to remove intact the posterior third of the meniscus without making a separate posterior incision. The plan adopted remains for the present a matter of opinion. It has been found in the present series of cases that removal of as much of the meniscus as is possible through an anterior incision has yielded such satis-factory results as hardly to warrant a routine extension of the operation. Although I have removed

the whole of a meniscus showing bucket-handle fracture with perfect results, I feel that while the procedure has yielded a good specimen it has been, perhaps, more drastic than was absolutely necessary; and that the simple excision of the dislocating central fragment is all that is actually required to ensure a good result. It is a good plan to commence the operation by isolating the anterior cornu and adjacent portion of the meniscus. If a longitudinal fracture is present and the capsular fragment is very narrow, the latter is then usually divided close to the junction of the anterior and middle thirds of the meniscus; the posterior attachment of the central fragment is then easily divided with scissors curved on the flat.

Two special instruments for use in these operations have been described and illustrated recently, both of which promise to be very useful additions to our armamentarium. Mr F. Wilson Stuart[15] has devised a forceps for securing that firm, non-slipping grip on the isolated anterior extremity of a meniscus which so greatly facilitates the excision of the remainder. Mr H.A.T. Fairbank[16] has designed a meniscotomy knife, modelled on the curved end of a Macdonald's dissector, for the special purpose of accurately dividing the posterior extremity of a meniscus through an anterior incision. The use of this/

this instrument should render even less frequent the indication for a second posterior incision for the complete removal of a meniscus.

V. PERSONAL CASES WITH COMMENTARIES.

In a series of 200 cases of surgical affections of the knee-joint seen by me in the five years from November 1924 to October 1929, 98 were diagnosed as suffering from traumatic internal derangement of the knee-joint. Of these 98 cases 33 were not operated upon, chiefly owing to their refusal for some reason or other to undergo the operation. These cases are tabulated below. (Table D.)

TABLE D.

Cases diagnosed: "Traumatic Internal Derangement of the Knee-Joint." No Operation Performed.

Diagnosis.		Cases.		Total
Lesion of Medial Meniscus	Right Knee	British Males	6	
		British Females	2	
		Indian Males	6	
	Left Knee	British Males	5	
		Indian Males	5	24
Lesion of Lateral Meniscus.	Left Knee	British Males	3	3
Lesion of Doubtful Nature.	Right Knee	British Male	1	
	Left Knee	British Male	1	2
Loose Body in the Joint.	Right Knee	British Males	2	
	Left Knee	British Male	1	
		Indian Male	1	4
		Total Cases		33

The remaining 65 cases were operated on and are classified in Table E.

TABLE E.

CASES DIAGNOSED: "TRAUMATIC INTERNAL DERANGEMENT OF THE KNEE-JOINT."
OPERATION PERFORMED.

DIAGNOSIS		CASES		CASES IN WHICH DIAGNOSIS WAS CONFIRMED AT OPERATION.		CASES IN WHICH DIAGNOSIS WAS ALTERED BY THE FINDINGS AT OPERATION.		NEGATIVE MENISCUS EXPLORATIONS.	
LESION OF MEDIAL MENISCUS	RIGHT KNEE	BRITISH MALES	25	CASES: 1 - 8 20 - 24 30 - 32	16	CASES: 45 - 46	2	CASES: 47-53	7
		INDIAN MALES	5	CASES: 9 - 10 25 - 26	4		—	CASE: 54	1
	LEFT KNEE	BRITISH MALES	13	CASES: 11 - 16 27 - 28 33 - 34	10		—	CASES: 55-57	3
		INDIAN MALES	7	CASES: 17 - 19 29	4		—	CASES: 58 - 60	3
LESION OF LATERAL MENISCUS	RIGHT KNEE	BRITISH MALES	3	—	0		—	CASES: 61-63	3
	LEFT KNEE	BRITISH MALES	4	CASES: 35-36	2		—	CASES: 64-65	2
FRACTURE OF INTERCONDYLOID EMINENCE OF TIBIA	RIGHT KNEE	BRITISH MALE	1	CASE: 37	1		—		—
LOOSE BODY IN THE JOINT	RIGHT KNEE	BRITISH MALE	1	CASE: 38	1		—		—
		INDIAN MALES	2	CASES: 39-40	2		—		—
	LEFT KNEE	BRITISH MALES	4	CASES: 41-44	4		—		—
TOTALS:			65		44		2		19

CASES NOS. 1 to 19 illustrate bucket-handle fractures of the medial meniscus with or without dislocation of the central fragment at the time of operation; where dislocated the central fragment had no appearance of rotation.

CASES NOS. 20 to 29 illustrate bucket-handle fracture-dislocations of the medial meniscus in which at operation the dislocated fragment appeared to be completely twisted over on itself on an antero-posterior axis.

CASES NOS. 30 to 34 are examples of comparatively uncommon lesions of the medial meniscus.

In all figures the anterior extremity of the meniscus is below, except in Fig. 44, where the anterior extremity is above. The drawings have been coloured yellow to distinguish between the normal glistening surfaces of the menisci and the lines of fracture and excision.

Abbreviations:

R.J. incision = the short anterior incision of Sir Robert Jones.

T.F. incision = the short anterior incision of Timbrell Fisher.

CASE NO. 1. British Male, age 26, December 1925.

HISTORY. He first injured the right knee by a twist at football in 1919. 'Water on the knee' resulted. Since then he has had a recurrence of 'water on the knee' after football once every year. Present attack due to a twist at tennis on the previous evening.

SIGNS and SYMPTOMS: Full extension of the knee is limited. During active extension from the flexed position of the knee a 'click' is palpable on the medial side of the joint. No joint effusion. Marked atrophy of the thigh. Tenderness is localised over the medial joint line midway between its anterior extremity and its middle point. Under general anaesthesia full extension of the knee was obtained and maintained by splinting. The patient was discharged from hospital on January 5th, 1926, with an apparently normal knee. He was readmitted on January 25th, 1926. In stepping off a raised verandah on the previous evening the knee locked in flexion.

OPERATION: February 1926, R.J. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found, with a very narrow capsular fragment. No apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE/

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital convalescent and walking fourteen days after operation. The 'click' in the joint was abolished. He returned to England soon after and was not traced.

SPECIMEN: Fig. 3. Upper surface of dislocated fragment of a bucket-handle fracture of the medial meniscus.

COMMENTARY: Owing to the rather vague history in this case with absence of locking, operation was delayed until the occurrence of definite locking made the diagnosis practically certain. This is, however, illustrative of the type of case in which, so far as the history is concerned, a simple traumatic recurrent synovial effusion of the knee-joint is the only indication of a meniscus lesion.

CASE NO. 2. British Male, age 23, October 1925.

HISTORY: On September 7th, 1925, he put out the right knee for the first time by twisting it at football. The knee locked in flexion. Joint effusion followed. Admitted to hospital on September 7th, 1925, and treated by manipulation and rest. Discharged October 17th, 1925, fit and well. On October 18th he trod on a loose brick with his right foot and the right knee 'went out'.

SIGNS/

SIGNS and SYMPTOMS: Movements of the knee complete. Joint distended by synovial effusion. No local tenderness. Skiagrams negative.

OPERATION: October 30th. 1925. R.J. incision, antero-medial arthrotomy. Complete bucket-handle fracture of the medial meniscus found without dislocation. Central fragment excised.

CONVALESCENCE: Complicated by low fever lasting seventeen days, and a painful sero-fibrinous synovial effusion into the joint which was aspirated twice. The exudate was sterile. Discharged from hospital convalescent and walking on December 15th. 1925, with marked wasting of the right thigh.

RESULT: December 1927. Is doing full duty, playing games and has had no further trouble with the knee since operation. On examination the knee-joint is normal, as is also the muscular development of the thigh.

SPECIMEN: Fig. 4. Upper surface of central portion of a bucket-handle fracture of the medial meniscus, showing a short transverse fracture of its free margin in the region of the junction of the middle and posterior thirds of the meniscus.

CASE NO. 3./

CASE NO. 3. British Male, age 23, May 1926.

HISTORY: While playing hockey on April 13th. 1926 he injured the right knee for the first time by jumping sideways and twisting the right knee inwards as he landed. The knee locked in flexion.

SIGNS and SYMPTOMS: Full extension of the knee is slightly limited. No joint effusion. Local tenderness over the anterior half of the medial joint line.

OPERATION: May 1926. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. No apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE: Uneventful.

RESULT: December 1927. He has had no further trouble with the knee.

SPECIMEN: Fig. 5. Under surface of dislocated fragment of bucket-handle fracture of the medial meniscus, showing peripheral fracture groove, the inferior lip of which shows signs of commencing central rotation in its posterior part. Transverse fracture of central sharp margin towards the posterior part of the middle third of the meniscus.

CASE NO.4/

CASE NO. 4. British Male, age 23, January 1928.

HISTORY. While playing football in 1925 he first injured his right knee by tripping over a tuft of grass as he ran. The knee did not lock, but swelled up. Since then he has had eight or nine attacks of 'water on the knee' following mild strains of the joint. On some of these occasions he has felt a grating sensation on the inner side of the knee, followed by something slipping out causing a palpable hard projection on its antero-medial aspect; this is accompanied by locking of the knee at an angle of about 160°. A few minutes' manipulation of the knee results in the disappearance of the protrusion and relieves the locking. The last occasion on which this happened was three days ago when he slipped coming down a hill.

SIGNS and SYMPTOMS: Movements of the knee are complete except for slight limitation of full flexion. Moderate joint effusion. Tenderness localised over the medial joint line just anterior to its middle point. Skiagrams negative.

FIRST OPERATION: February 1928. T.F. incision, antero-medial arthrotomy. No abnormality could be detected in the medial meniscus, and the joint was closed.

CONVALESCENCE: Uneventful. Discharged from hospital sixteen days after the operation.

AFTER HISTORY: A month later while in bed he turned over onto his right side and put out the right knee with pain on its antero-medial aspect. The knee locked in flexion and he was unable to reduce it as on previous occasions. On the following day he was readmitted to hospital with limited extension of the knee, joint effusion and acute tenderness localised over the anterior end of the medial joint line.

SECOND OPERATION: April 1928. Scar of previous operation excised; joint opened. A quantity of orange tinted synovial fluid evacuated. Bucket-handle fracture-dislocation of the medial meniscus found. There was no apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE: Uneventful.

RESULT: October 1928. He has had no further trouble with the knee, which feels perfectly strong. He is doing full duty and playing games.

SPECIMEN: Fig. 6. Upper surface of central fragment of a bucket-handle fracture of the medial meniscus, showing transverse fracture of the sharp free margin in the region of the junction of its middle and posterior thirds. Behind this gaping fracture can be seen a portion of the smooth surface of the rotated inferior lip of the peripheral fracture groove. Attached to the posterior extremity of the fragment is a narrow strip of the capsular fragment.

Fig. 7. Under surface of the specimen, showing deep peripheral fracture groove of its posterior half with central rotation of its inferior lip. The anterior half of the peripheral margin of the fragment shows an oblique plane surfaced line of fracture passing from above down and centralward. This surface is infiltrated with blood indicating a recent forward extension of the fracture of the posterior half.

COMMENTARY: A case of primary lesion of the posterior half of the medial meniscus which could not be detected through the usual anterior incision. Further trauma extended the line of fracture forwards rendering the lesion obvious at the second operation.

CASE NO. 5. British Male, age 26, March 1928.

HISTORY: He first damaged the right knee in March 1925 at football. He and an opposing player kicked the ball at the same time and the resulting jar put out his knee; the knee locked in flexion and he fell; later the knee swelled up. Since then the knee has gone out repeatedly, sometimes thrice in one week, sometimes at intervals of three months. A slight twist of the knee such as follows a step on a loose pebble suffices to put it out. When the knee/

knee goes out there is a sharp pain in the antero-medial part of the joint; he kicks the knee about, and after a short time it goes back with a click accompanied by a repetition of the pain. The knee frequently 'clicks' without actually going out. The knee went out yesterday when he was sitting in a motor lorry with his right knee crossed over the left knee. When he uncrossed the knees the right knee locked and he has not been able to straighten it since.

SIGNS and SYMPTOMS: Extension of the knee is limited. Marked tenderness localised to the medial joint line just anterior to its middle point. Skiagrams negative.

OPERATION: March 1928. T.F. incision, antero-medial arthrotomy. Excess of slightly blood stained synovial fluid evacuated. Medial meniscus appeared quite normal to inspection and exploration with hook. The anterior third of the meniscus was isolated by dissection and traction on this produced a dislocation of the central fragment of a bucket-handle fracture which did not extend into the anterior third of the meniscus. The excision of the meniscus was completed.

CONVALESCENCE: Uneventful.

RESULT: October 1928. He is doing full duty and has had no further trouble with the knee, which is normal on examination.

SPECIMEN: Fig. 8. The upper surface of the medial meniscus showing bucket-handle fracture. The fracture surfaces are oblique from above down and peripheralward. There is a secondary transverse fracture of the sharp margin of the central fragment in the region of the junction of the middle and posterior thirds of the meniscus. The posterior extremity of the meniscus, with which both fragments were in continuity, has escaped excision.

COMMENTARY: A case which illustrates the difficulty in detecting through the usual anterior incision a lesion of a meniscus which does not extend into its anterior third.

CASE NO. 6. British Male, age 23, March 19th. 1928.

HISTORY: Eight days ago while playing rugby football he fell making a tackle and his right knee twisted inwards. He got up and limped off the field unable to straighten his right knee and with severe pain on its antero-medial aspect. The knee swelled up the same night. No history of any previous knee trouble.

SIGNS and SYMPTOMS: Limited extension of the right knee. Moderate joint effusion. Local tenderness over the anterior end of the medial joint line. Skiagrams negative.

OPERATION/

OPERATION: March 23rd. 1928. T.F. incision, antero-medial arthrotomy. Large excess of synovial fluid evacuated. Bucket-handle fracture-dislocation of the medial meniscus found. No apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE: Uneventful.

RESULT: October 1928. Does full duty and commenced playing football and hockey regularly last month. No further trouble with the knee which is normal on examination.

SPECIMEN: Fig. 9. Upper surface of dislocated fragment of a bucket-handle fracture of the medial meniscus. Transverse fracture of the sharp margin in the region of the junction of the middle and posterior thirds of the meniscus. Short anterior portion of narrow capsular fragment.

Fig. 10. Under surface of the specimen showing oblique fracture surface passing from above down and centralward.

CASE NO. 7. British Male, age 27, March 1928.

HISTORY: Five years ago while doing a cross-country run he sprained his right knee. The knee swelled up, but he made a speedy recovery and has had no further trouble with the knee until sixteen days ago while playing football he turned sharply to his/

his right while running, with his right foot placed in a hollow of the ground; the right knee went inwards and he fell with pain on the postero-lateral aspect of the joint. He was unable to continue playing.

SIGNS and SYMPTOMS: Full flexion of the knee is limited; extension is complete. Effusion into the joint. Tenderness localised at the anterior end of the medial joint line. Skiagrams negative. The joint was aspirated and 20 ccs. of yellow synovial fluid were withdrawn. As there was no history of locking the patient was discharged from hospital after a fortnight. Early in August 1928 he was playing hockey and turned sharply to his left; as he turned he felt something slip in the antero-medial part of the joint, with some slight pain. He sat down and found he could not straighten the knee. The knee was pulled straight and he resumed playing. The knee did not swell up. Three weeks later the same thing happened again during a game of hockey. He was admitted to hospital the next day with limited extension of the knee, but no joint effusion.

OPERATION: August 1928. T.F. incision, antero-medial arthrotomy. The medial meniscus presented a complete bucket-handle fracture-dislocation. There was no apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE/

CONVALESCENCE: Uneventful.

RESULT: October 1928. He has had no further trouble with the knee, which is normal on examination.

SPECIMEN: Fig. 11. Upper surface of dislocated fragment of a bucket-handle fracture of the medial meniscus. There is a transverse fracture of its sharp margin in the region of the junction of the middle and posterior thirds of the meniscus.

Fig. 12. Under surface of the specimen showing peripheral fracture groove, the inferior lip of which has undergone partial central rotation towards the sharp margin.

CASE NO. 8. British Male, age 26, August 1929.

HISTORY: A year ago during a storm at sea he slipped and struck the inner side of his right knee against a steam winch. Painful swelling of the knee supervened. In the early part of 1929 he began to notice that something slipped in his right knee if he bent it very much, as in squatting; the slipping is followed by a fugitive pain in the joint, a sense of weakness in the knee and sometimes by swelling of the knee. When this slipping occurs he kicks out the knee vigorously until it "goes back". The slipping has become gradually more frequent and during the last two or three months has occurred nearly every day.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Localised tenderness over the middle of the anterior half of the medial joint line. Skiagrams negative. He demonstrated the 'slipping' by standing on his left leg and fully flexing his right knee. There was no audible or palpable click; but when he had done this the tender edge of an abnormal structure became palpable in the middle of the antero-medial joint triangle. He then kicked the knee straight and palpation was negative.

OPERATION: September 1929. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture of the medial meniscus found. The central fragment, when dislocated into the central joint area with a probe, assumed a sinuous shape. This dislocation must have been associated with the slipping complained of by the patient; and it was clear that under these conditions the anterior part of the peripheral margin of the dislocated fragment had become palpable externally. The medial meniscus was completely excised.

CONVALESCENCE: Uneventful.

RESULT: November 1929. Functional result perfect; no further slipping has occurred.

SPECIMEN: Fig. 12A. The upper surface of a complete bucket-handle fracture of the medial meniscus. There/

There is a transverse fracture of the sharp margin in the region of the junction of the middle and posterior thirds of the meniscus. The fracture line is grooved in the capsular fragment and wedge shaped in the central fragment except in short anterior and posterior segments where the fractured surfaces are plane and vertical. Tags of synovial membrane are attached to the anterior and posterior extremities of the peripheral margin of the capsular fragment.

CASE NO. 9. Indian Male, age 26, September 1926.

HISTORY: He first injured his right knee in June 1926 by falling from his horse onto his knees. He was treated in hospital for a fortnight for 'traumatic synovitis'. As soon as he resumed his riding the joint effusion recurred.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Tenderness localised to the anterior half of the medial joint line and to the medial condyle of the tibia just below this.

OPERATION: October 1926. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture of the medial meniscus found. The two fragments were in perfect apposition, so that at first glance the meniscus appeared to be undamaged. Central fragment excised.

CONVALESCENCE: Uneventful.

RESULT: February 1927. On examination the knee appeared perfectly normal. Sound scar; movements complete; no muscular atrophy. The patient states that the operation has relieved the previous constant discomfort in the knee, but complains of inability to do hard work; and that the scar is tender and prevents him gripping his saddle properly. He had to be invalided with a nominal percentage disability.

SPECIMEN: Fig. 13. Upper surface of central fragment of a bucket-handle fracture of the medial meniscus showing a transverse fracture of the sharp margin in the region of the junction of the middle and posterior thirds of the meniscus, and the peripheral fracture groove.

COMMENTARY: Indian troops are sadly prone to magnify any traumatic disability however trivial.

CASE NO. 10. Indian Male, age 29, February 1929.

HISTORY: In October 1928, while he was playing hockey, the ball struck the antero-medial surface of his right knee. He was admitted to hospital and treated for synovitis of the right knee. He was discharged after one month. On February 18th. 1929 he injured the knee for the second time by colliding with another player at football.

SIGNS and SYMPTOMS: Limited extension and flexion of the knee. Marked joint effusion. Exquisite tenderness localised to the anterior half of the medial joint line. Slight tenderness over the insertion of the tibial collateral ligament and over the origin and insertion of the fibular collateral ligament. Skiagrams negative.

OPERATION: February 23rd.1929. T.F. incision, antero-medial arthrotomy. Bucket-handle fracture-dislocation of the medial meniscus found. No apparent rotation of the dislocated fragment which was excised with a portion of the capsular fragment and a large hypertrophied semilunar pad of fat.

CONVALESCENCE: Post-operative haemarthrosis. Two ounces of blood were aspirated from the joint on the sixth day after operation. Convalescence thereafter was uneventful.

RESULT: Discharged from hospital convalescent, walking well, knee-joint normal. Not traced.

SPECIMEN: Fig. 14. Upper surface of a bucket-handle fracture of a medial meniscus, including the whole of the central fragment and the anterior portion of the capsular fragment. The anterior half of the peripheral border of the central fragment shows a broad, oblique fracture surface sloping from above down and centralward with a corresponding fracture surface on the anterior strip of capsular fragment. The posterior half of the peripheral border/

border of the central fragment shows a deeply grooved wedge fracture, the inferior lip of which is completely rotated centrally and can be seen projecting beyond the sharp free margin of the meniscus with which it has formed a central smooth surfaced groove.

Fig. 15. Under surface of the specimen showing oblique plane surfaced fracture on the anterior half of the peripheral border of the central fragment and groove fracture on the posterior half of that border, the groove having been completely flattened out by the central rotation of its inferior lip. Both the above figures also show the anterior hypertrophied semilunar pad of fat.

Fig. 16. Post-operation temperature chart.

CASE NO. 11. British Male, age 25, July 1926.

HISTORY: A year ago a horse fell pinning his left leg under it. The left knee swelled up. After five days he returned to duty. Since then the knee has been liable "to give" with pain and fleeting swelling of the joint if twisted inwards. He has learned a trick of manipulating the head of the tibia, rotating it medially with his hands, which relieves the pain on these occasions. Yesterday evening he twisted the knee inwards while bowling at/

at cricket and felt acute pain in the antero-medial region of the joint.

SIGNS and SYMPTOMS: Movements of the knee are complete. Slight joint effusion. Acute tenderness localised over the anterior extremity of the medial joint line.

OPERATION: November 1926. T.F. incision, antero-medial arthrotomy. The medial meniscus appeared normal on first inspection, but exploration with a blunt hook detected a line of fracture in the middle third of the meniscus. The meniscus was excised.

CONVALESCENCE: Uneventful except for a post-operative relapse of Malaria.

RESULT: January 1928. The knee has given no further trouble. He rides and does full duty.

SPECIMEN: Fig. 17. Upper surface of a bucket-handle fracture of the medial meniscus. The posterior part of the capsular fragment has escaped excision. There is a transverse fracture of the sharp margin of the meniscus in the region of the junction of its middle and posterior thirds. The longitudinal line of fracture reaches in front to the junction of the anterior and middle thirds of the meniscus.

CASE NO. 12/

CASE NO. 12. British Male, age 24, February 1927.

HISTORY: In June 1924, while playing football, he was running straight to his front when his left knee gave way with acute pain on the antero-medial aspect of the joint. Later the knee became swollen. He was unable to straighten the knee until about ten days after the injury. Since then the knee has given way under him very frequently as he has been walking, always accompanied by pain as described above, but only on two or three occasions followed by swelling.

SIGNS and SYMPTOMS: Extension of the knee is limited. No joint effusion. Marked tenderness localised along the anterior half of the medial joint line. Skiagrams negative.

OPERATION: March 1927. T.F. incision, antero-medial arthrotomy. Bucket-handle fracture-dislocation of the medial meniscus found. No apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE: Uneventful.

RESULT: February 1928. He has had no further trouble with the knee.

SPECIMEN: Fig. 18. Upper surface of central fragment of a bucket-handle fracture of the medial meniscus with a tag of synovial membrane attached to the peripheral margin of the unfractured anterior third of/

of the meniscus. Posteriorly the completely rotated inferior lip of the peripheral fracture groove projects beyond the central sharp margin of the meniscus.

Fig. 19. Under surface of the specimen showing deep peripheral fracture groove involving the middle and posterior thirds of the meniscus, with central rotation of the inferior lip of the groove.

CASE NO. 13. British Male, age 24, March 1927.

HISTORY: He first injured his left knee in September 1925 by"giving it a jar" at football. The knee swelled up; but the swelling quickly subsided after application of wet bandages. On January 3rd. 1927 he twisted the knee again at football. His left foot got stuck in a hole in the ground and the left knee "went outwards". He fell and then limped off to hospital where he was under treatment until February 12th. On March 19th. 1927 he was playing football and kicked the ball with his right foot. He then fell over onto his face and found that his left knee was locked in flexion. This is the first occasion on which the knee has definitely locked.

SIGNS and SYMPTOMS: Limited extension of the knee. Effusion into the joint. Marked tenderness localised along the anterior fourth of the medial joint line. Skiagrams negative.

OPERATION: March 1927. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. No apparent rotation of the dislocated fragment which was excised. A small depression was noted on the cartilaginous surface of the medial condyle of the tibia close to the anterior cornu of the medial meniscus; the sides of the depression sloped down to a smooth bony floor.

CONVALESCENCE: Uneventful.

RESULT: December 1927. He is doing full duty and playing games. His left knee keeps locking as before operation, though "not so badly"; when it locks he can straighten the knee by pressing on its medial surface. The knee sometimes swells up after locking. He has not required admission to hospital since the operation. On examination the knee appeared normal.

SPECIMEN: Fig. 20. Upper surface of central fragment of a bucket-handle fracture of the medial meniscus, showing a transverse fracture of its sharp margin in the region of the junction of the middle and posterior thirds of the meniscus.

Fig. 21. Under surface of the specimen showing almost complete central rotation of the short inferior lip of the peripheral fracture groove forming a central smooth surfaced groove.

COMMENTARY/

COMMENTARY: The post-operative symptoms were probably due to a loose body in the joint which up to the time when he was last seen had not been located.

CASE NO. 14. British Male, age 24, October 1927.

HISTORY: In September 1925, while playing football, he was running straight to his front when he tripped on a tuft of grass and fell and put out his left knee. Since then the knee has "been out" five or six times, the last occasion being two weeks ago when he fell off his bicycle owing to a dog getting in his way. When the knee goes out it locks in flexion with pain on its antero-medial aspect; later the knee swells up. The recurrences are becoming more frequent, but the pain is less severe in each successive attack.

SIGNS and SYMPTOMS: Extension of the knee is complete; slight limitation of full flexion. No joint effusion. Tenderness localised over the medial joint line at a point midway between its centre and its anterior end. No muscular wasting.

OPERATION: November 1927. T.F. incision, antero-medial arthrotomy. At first glance the medial meniscus appeared to be undamaged; closer inspection detected a bucket-handle fracture with the fragments in perfect apposition. Total excision of the meniscus was performed.

CONVALESCENCE: Uneventful.

RESULT: October 1928. Patient states that the operation has yielded a perfect cure. He does full duty, plays games and has had no further trouble with the knee.

SPECIMEN: Fig. 22. Upper surface of a bucket-handle fracture of the medial meniscus. Short longitudinal fracture of the posterior third of the central fragment; and transverse fracture of the sharp margin in the region of the junction of the middle and posterior thirds of the meniscus.

Fig. 23. Under surface of the specimen showing broad shallow grooved fracture surface on the peripheral margin of the central fragment, and narrow wedge shaped capsular fragment.

CASE NO. 15. British Male, age 24, January 1928.

HISTORY: In April 1927 he first injured his left knee. While playing football he was charged and fell on his left side with his left leg doubled up under him; there was severe pain all over the knee, which swelled up later. The knee has been weak ever since. He gave up games until December 1927 when he played a game of football. During the game as he was turning to the right pivoting on his left foot, the left knee went out. Since then the knee/

knee has been out twice, once at football and once when walking he turned to his right.

SIGNS and SYMPTOMS: Full extension of the knee; slight limitation of full flexion. Slight joint effusion. Tenderness localised to the medial joint line just anterior to its middle point. Muscle tone and nutrition normal. Skiagrams negative.

OPERATION: March 1928. T.F. incision, antero-medial arthrotomy. On first inspection the medial meniscus appeared undamaged; exploration with a blunt hook detected a longitudinal line of fracture close to the capsular attachment of the meniscus. The meniscus was excised.

CONVALESCENCE: Uneventful.

RESULT: October 1928. He states that the result of the operation is perfectly satisfactory. He is doing full duty and plays all games. On examination the knee appears normal.

SPECIMEN: Fig. 24. Upper surface of a bucket-handle fracture of the medial meniscus. The connection of the capsular fragment with the posterior extremity of the meniscus was divided during the excision. The peripheral fracture surface of the central fragment shows a shallow groove at its anterior end which changes posteriorly into an oblique broad fracture surface passing from above down and centralward/

centralward. There is a transverse fracture of the free sharp margin in the region of the junction of the middle and posterior thirds of the meniscus.

CASE NO. 16. British Male, age 22, January 1929.

HISTORY: He first injured his left knee at football in November 1925. The knee became stiff and swollen after the game. Since then the knee has gone out and swelled up on more than ten occasions, usually following a turning movement to his right. He last put out the knee in October 1928; while running he tripped with his left foot in a gutter and fell; there was pain on the antero-medial aspect of the joint. No history of definite locking obtained.

SIGNS and SYMPTOMS: Full flexion and extension of the knee are limited. The knee presents a puffy fulness, but no fluctuation or patellar tap can be elicited. Tenderness is localised to the anterior half of the medial joint line. There is marked loss of tone in the left quadriceps extensor muscle.

OPERATION: January 1929. T.F. incision, antero-medial arthrotomy. Bucket-handle fracture of the medial meniscus found. The central fragment floated in excess of synovial fluid alongside the capsular fragment. Traction on the anterior extremity of the central fragment caused it to dislocate into the

the central joint area, the dislocation being accompanied by a rotation of the fragment which brought its torn peripheral margin into contact with the articular surface of the tibia. Complete excision of the meniscus.

CONVALESCENCE: Uneventful.

RESULT: Discharged convalescent and walking well. Not traced.

SPECIMEN: Fig. 25. The under surface of a bucket-handle fracture of the medial meniscus, the connection between the posterior ends of the fragments having been divided during the excision. There is a transverse fracture of the central sharp margin of the meniscus in the region of the junction of its middle and posterior thirds. The peripheral margin of the central fragment presents a groove fracture in its anterior half and an oblique, plane-surfaced fracture in its posterior half. The peripheral fragment presents a wedge fracture in its anterior half and an oblique, plane-surfaced fracture in its posterior half. The two fragments approximated fit together exactly.

COMMENTARY: An operative observation on a mechanism of the dislocation of the central fragment of a bucket-handle fracture of a meniscus is recorded. Vide Case No. 24.

CASE NO. 17. Indian Male, age 22, April 1926.

HISTORY: He first injured his left knee two months ago by twisting it when climbing a hill. He was treated in hospital for a month for "synovitis". Four days ago he twisted the knee again at musketry. He felt pain at the back of the knee, and also, when bending the knee, on its antero-medial aspect.

SIGNS and SYMPTOMS: Complete extension of the knee; flexion slightly limited. No joint effusion. Tenderness localised to the femoral origin of the tibial collateral ligament. Skiagrams negative. After twelve days in hospital he was discharged to duty; but was readmitted a fortnight later complaining of persisting discomfort in the antero-medial region of the joint on marching or running.

OPERATION: May 1926. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. No apparent rotation of the dislocated fragment which was excised.

CONVALESCENCE: Uneventful.

RESULT: November 1926. He has had no further trouble with the knee and is doing full duty. On examination the knee appears normal. This patient took his discharge from the Army in December 1927, and up to that time had no further trouble with the knee.

SPECIMEN: Fig. 26. The upper surface of the central fragment of a bucket-handle fracture of the medial meniscus. Its peripheral margin shows a grooved fracture. There is a transverse fracture of the free sharp margin in the region of the junction of the middle and posterior thirds of the meniscus.

CASE NO. 18. Indian Male, age 26, September 1926.

HISTORY: He injured his left knee for the first time by falling off a horse in January 1926. He was treated in hospital for "synovitis of the knee". Since then he has been admitted to hospital on three more occasions for recurrence of joint effusion, brought on by riding or marching.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Tenderness localised to the anterior half of the medial joint line. Marked wasting of the left quadriceps extensor muscle. Skiagrams negative.

OPERATION: October 1926. T.F. incision, antero-medial arthrotomy. Bucket-handle fracture of the medial meniscus found, with the fragments lying in apposition. Medial meniscus excised.

CONVALESCENCE: Uneventful.

RESULT: February 1927. The patient states that the operation has improved the knee greatly. The joint appears/

appears normal on examination, but there is still comparative wasting of the left thigh as compared with the right thigh. He complains of inability to ride properly owing to tenderness in the operation scar, although this is situated well in front of the area of the knee used in gripping a saddle. On this account he had to be invalided out of the Army with a nominal percentage disability.

SPECIMEN: Fig. 27. Upper surface of a bucket-handle fracture of the medial meniscus. The central fragment has been separated from its posterior attachment during the excision; and the posterior portion of the capsular fragment has escaped excision. The line of fracture on the peripheral margin of the central fragment is an oblique plane surface sloping from above down and peripheralward. There is a transverse fracture of the free sharp margin of the meniscus in the region of the junction of its middle and posterior thirds.

CASE NO. 19. Indian Male, age 24, July 1928.

HISTORY: In December 1927, while engaged in making a pontoon-bridge, he fell into a pontoon. His left knee went out and locked in flexion. The knee swelled up. He was treated in hospital for three weeks and had no further trouble with the knee/

knee until five days ago when, as he rose erect from a squatting posture, something "clicked" in the left knee with pain on its medial side, followed by swelling of the knee.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Tenderness localised to the anterior half of the medial joint line. When the knee is actively extended from the fully flexed position a marked double 'click' is audible and palpable on the medial side of the joint line, accompanied by a jerking movement of the medial condyle of the tibia on the femoral condyle. Muscle tone and nutrition normal. Skiagrams negative.

OPERATION: January 1929. T.F. incision, antero-medial arthrotomy. Double bucket-handle fracture-dislocation of the medial meniscus found, both central fragments lying dislocated in the central joint space with no apparent rotation. Excision of the medial meniscus performed.

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital with normal function and the knee normal on examination. Not traced.

SPECIMEN: Fig. 28. The upper surface of a double bucket-handle fracture of the medial meniscus. The posterior strip of the capsular fragment has escaped excision. The posterior attachments of both/

both central fragments were divided during the excision. The capsular strip presents an oblique fracture surface from above down and centralward. The middle fragment presents a smooth glistening surface with thin edges. The central fragment is smooth and glistening on all its aspects with the exception of a small area at its original posterior attachment and a small area in the angle between it and the middle fragment. It has a sharp, free central margin, interrupted by a transverse fracture in the region of the junction of the middle and posterior thirds of the meniscus. Its peripheral border is bluntly rounded and thickened.

Fig. 29. The under surface of the specimen with its fragments approximated. The under surface of the middle fragment presents a rough, torn surface which is V-shaped in cross-section, the central limb of the V being much longer than the other limb. It is obvious that the peripheral margin of the central fragment presented originally an oblique, plane surfaced line of fracture corresponding with the central portion of the V-fracture on the under surface of the middle fragment. This margin has become completely folded over on itself and the opposed raw surfaces have firmly united together.

COMMENTARY/

COMMENTARY: M'Murray has been quoted above as stating that a click or snap at the end of active extension of the knee accompanied by a slipping movement of the tibia on the femur is pathognomonic of a lesion of the lateral meniscus. In this case we have found this sign associated with a lesion of the medial meniscus. The sign could no longer be elicited after the operation, so that a concomitant lesion of the lateral meniscus can be excluded.

CASE NO. 20. British Male, age 23, February 1926.

HISTORY: He first injured his right knee at football in March 1925. Since then the knee has locked and swollen up more than ten times. As time goes on the knee after locking does not swell so much. He last put out the knee three days ago in the act of kicking a football with his right foot.

SIGNS and SYMPTOMS: Movements of the knee are complete. Moderate joint effusion. Tenderness localised over the anterior end of the medial joint line.

OPERATION: February 1926. R.J. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its anterior and posterior attachments through 180° into the central joint area. The dislocated fragment was excised.

CONVALESCENCE: Uneventful.

RESULT: December 1927. He has had no further trouble with the knee. He is doing full duty and playing games.

SPECIMEN: Fig. 30. Under surface of the central fragment of a bucket-handle fracture of the medial meniscus. It shows complete central rotation of the inferior lip of the original peripheral fracture groove, which is thus flattened out into a plane surface. The new formed central smooth surfaced groove can be seen, with a small portion of the under surface of the free sharp margin of the meniscus projecting beyond the rotated inferior lip.

CASE NO. 21. British Male, age 21, March 1926.

HISTORY: He first injured his right knee in 1922 by slipping when climbing a hill. There was pain on the medial side of the knee. The joint did not lock, but it swelled up. He has had trouble with the knee four times since then, the last occasion being on March 20th. 1926 when the knee suddenly locked while he was playing hockey, and threw him over.

SIGNS and SYMPTOMS: Movements of the knee are complete. Joint effusion present. No pain or tenderness. Skiagrams negative.

OPERATION: April 10th. 1926. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found, with apparent rotation of the dislocated fragment on its anterior and posterior attachments through 180° into the central joint space. The dislocated fragment was excised.

CONVALESCENCE: Post-operative clear joint effusion aspirated on April 28th; the effusion recurred and subsided gradually under treatment with Scott's dressing, pressure bandage, rest and later massage.

RESULT: December 1926. Knee normal on examination. He is doing full duty, but not playing games. In January 1927 he was playing in his third game of football since the operation when he was tackled, and twisted his right knee severely. He was re-admitted to hospital with joint effusion which subsided rapidly under treatment. Palpation of the moving joint yielded a crepitant sensation. He was advised to play no more football for a year. He was re-examined in December 1927. He is doing full duty and is playing games contrary to advice. He occasionally feels some weakness in the knee after a long march. Movements of the knee are complete; there appears to be a slight excess of fluid in the joint, but no crepitant sensation was elicited.

SPECIMEN/

SPECIMEN: Fig. 31. The upper surface of the central fragment of a bucket-handle fracture of the medial meniscus, showing the smooth surfaced central groove formed by the complete central rotation of the inferior lip of the peripheral fracture groove; this lip is seen projecting beyond the anterior half of the free sharp margin of the meniscus.

Fig. 32. Under surface of the specimen, showing the original peripheral fracture groove opened out and converted into a roughened plane surface by the complete central rotation of its inferior lip, which now forms with the sharp free margin of the meniscus a secondary smooth surfaced central groove which can be seen at the posterior end of the specimen.

COMMENTARY: A case in which the affected knee is probably the seat of some degree of chronic arthritis secondary to old standing internal derangement. It is to be noted that locking of the knee appeared only at the fourth recurrence.

CASE NO. 22. British Male, age 25, January 1927.

HISTORY: He first put out his right knee in Cairo in 1922. He was kicked on the instep of his right foot at football, and the right knee "went inwards". Since then the knee has gone out at football generally/

generally once or twice each season. He last put out the knee on December 12th.1926 at football, when he was again kicked on the right instep.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Marked tenderness localised over the medial joint line near its anterior end; full flexion of the knee causes rather acute discomfort in the antero-medial region of the joint. Some wasting and loss of tone of the right Vastus medialis muscle.

OPERATION: February 1927. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its anterior and posterior attachments through 180° into the central joint space. The meniscus was excised.

CONVALESCENCE: Uneventful.

RESULT: January 1928. The knee has given no further trouble. He rides and does full duty. He plays football with much vigour and success.

SPECIMEN: Fig. 33. Upper surface of a bucket-handle fracture of the medial meniscus, showing shortening of the central fragment, secondary to long standing dislocation, so that it cannot be properly approximated to the capsular fragment. In its anterior half the inferior lip of the peripheral fracture groove/

groove of the central fragment has become completely folded over to form with the sharp margin of the meniscus a central groove. In the centre of the central margin of the dislocated fragment this groove is obliterated by organised adhesion. The posterior half of the inferior lip is incompletely rotated so that here the original peripheral fracture groove can still be demonstrated.

Fig. 34. The under surface of the specimen also showing the above appearances. The rotated anterior half of the inferior lip has been unfolded as far as possible to demonstrate the area of organised adhesion at the centre of the free border of the meniscus. The capsular fragment shows a wedge shaped fracture surface.

CASE NO. 23. British Male, age 25, July 1928.

History: He first injured his right knee in September 1927 while playing football. He jumped to head the ball and, colliding with an opponent, felt something strike his right knee on its antero-medial aspect and fell to the ground. He found the right knee bent and could not straighten it. An attempt to pull the knee straight caused acute pain on the antero-medial aspect of the joint and gave him the sensation of something inside the joint obstructing extension/

extension. Swelling of the knee supervened. The knee straightened gradually in hospital and at the end of three weeks appeared to be normal. In December 1927 he put out the knee again at football. In January 1928 he put out the knee as he uncrossed his right knee while sitting playing cards. In February he put out the knee while kicking a foot-ball about. In May the knee went out while he was swimming; and, finally, in June he put out the knee while riding, in the act of spurring his horse. After being laid up on these several occasions he has noticed wasting of the right Vastus medialis muscle; but by practising exercises he has usually restored the muscle to normal before being laid up again.

SIGNS and SYMPTOMS: Movements of the knee are com-plete. No joint effusion. Slight tenderness local-ised to the medial joint line just anterior to its middle point. Marked atrophy and atony of the right Vastus medialis muscle. Skiagrams negative.

OPERATION: November 1928. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found, with apparent rotation of the dislocated fragment on its anterior and posterior attachments through 180° into the central joint area. Meniscus excised.

CONVALESCENCE: Uneventful.

RESULT/

RESULT: Discharged from hospital with normal function and a sound knee. Not traced.

SPECIMEN: Fig. 35. Upper surface of a bucket-handle fracture of the medial meniscus. The continuity of the posterior ends of the capsular and central fragments was destroyed during the excision. The central margin of the capsular fragment shows an oblique plane fracture surface passing from above down and centralward in its anterior two thirds. The central fragment is attached anteriorly by a narrow smoothly rounded pedicle. All its surfaces and margins are smooth and glistening with the exception of a small area at its posterior extremity; no indication of the line of fracture could be detected on this fragment. Anteriorly it is doubled over on itself, and the doubled over portion is markedly thickened.

Fig. 36. The upper surface of the specimen with the fragments approximated; the doubled over portion of the central fragment has been unfolded as far as possible.

CASE NO, 24. British Male, age 25, December 1928.

HISTORY: On December 5th. 1928, at football, he was charged on his left side and withstood the force of the impact with his extended right lower limb. He thinks that the force of the charge twisted him round/

round to his left, the right foot remaining fixed on the ground. He collapsed with great pain in the right knee; He found the knee bent at right angles and he could not straighten it. He crawled off the field and was taken to hospital where, under general anaesthesia, the knee was straightened and splinted in extension. Next day the knee was much swollen.

SIGNS and SYMPTOMS: December 24th. 1928. Limited flexion and extension of the knee. No joint effusion. Tenderness localised over the anterior half of the medial joint line, maximum at its anterior end. There is also some tenderness over the origin and insertion of the tibial collateral ligament. Skiagrams negative.

OPERATION: January 2nd. 1929. T.F. incision, antero-medial arthrotomy. Bucket-handle fracture-dislocation of the medial meniscus found, with apparent rotation of the dislocated fragment on its anterior and posterior extremities through 180° into the central joint space. Dislocated fragment excised.

CONVALESCENCE: Uneventful.

RESULT: Discharged convalescent and walking well on January 18th. 1929. Not traced.

SPECIMEN: Fig. 37. Upper surface of anterior extremity and central fragment of a bucket-handle fracture of the medial meniscus, showing narrow, wedge shaped, short, anterior portion of the capsular fragment/

fragment and groove fracture along the anterior two-thirds of the peripheral margin of the central fragment.

Fig. 38. Under surface of the specimen showing groove fracture on the anterior two-thirds and oblique plane surfaced fracture on the posterior third of the peripheral margin of the central fragment.

Fig. 39. This shows the appearance of the dislocated fragment as it lay exposed within the joint at operation. The anterior two-thirds of the fragment is seen to be rotated so that its free sharp margin is directed upwards towards the inter-condylar notch of the femur and its grooved peri-pheral margin rests on the cartilage of the medial condyle of the tibia; the groove is flattened out so that its upper lip is seen on the right and its lower lip on the left of the free sharp margin to which the latter lip is approximated with the resulting formation of a new smooth surfaced central groove. The condition was sufficiently recent to allow the lower lip to resume its normal position on removal of the fragment from the joint.

COMMENTARY: The mechanism of the dislocation of the central fragment in this case is shown to be the same as that noted and described in Case No.16.

CASE NO. 25. Indian Male, age 35, January 1927.

HISTORY: In January 1925, while playing football, he twisted his right knee which locked in flexion. The joint swelled up later. Five months afterwards he put out the knee again while playing hockey. Since then he has had "water on the knee" several times.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No pain or tenderness. He states that he can feel something slip on the medial side of the knee when he bears his weight on it, but nothing corresponding to his sensation is audible or palpable.

OPERATION: February 1927. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its anterior and posterior attachments through 180° into the central joint area. Dislocated fragment and portion of capsular fragment excised.

CONVALESCENCE: Uneventful.

RESULT: December 1927. The patient has had no further trouble with the knee and plays football and hockey regularly.

SPECIMEN/

SPECIMEN: Fig. 40. Upper surface of central fragment and anterior half of capsular fragment of a bucket-handle fracture of the medial meniscus. The anterior half of the central margin of the dislocated fragment is thick and presents a shallow, smooth-surfaced groove; the posterior half of that margin presents its normal sharp appearance. The portion of capsular fragment shows a wedge shaped fracture.

Fig. 41. Under surface of the specimen, the two portions of which have been approximated. If the peripheral margin of the central fragment be examined it will be seen that in its anterior half it presents a deeply grooved fracture surface the inferior lip of which has become completely rotated over towards the sharp margin. Secondary structural changes have fixed the lip in its rotated position and obliterated the major portion of the new formed central groove. In its posterior half the peripheral margin of the central fragment presents a plane fracture surface passing obliquely from above down and centralward.

CASE NO. 26. Indian Male, age 32, July 1928.

HISTORY: While playing football four years ago he received a kick on the antero-lateral surface of his right knee. He fell. The knee swelled up. Since/

Since then he has put out the knee ten times, each of which occasions he described accurately and minutely. The last occasion was three months ago; he was squatting cross-legged on his bed writing when he felt that his right leg had "gone to sleep"; he eased the limb from under him and tried to straighten the knee, but found he could not do so. Swelling of the knee followed. Locking of the knee in flexion has occurred on each occasion accompanied by pain on the antero-medial aspect of the joint.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No tenderness. Lack of tone in the right Vastus medialis muscle is evident when he stands with his knees braced back. Skiagrams negative, except for a small cancellous exostosis on the medial surface of the proximal end of the tibia.

OPERATION: July 1928. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its attached extremities through 180° into the central joint area. The dislocated fragment was excised.

CONVALESCENCE: Uneventful.

RESULT: The patient was discharged from hospital with a perfect functional result. Not traced.

SPECIMEN: Fig. 42. Upper surface of a portion of a bucket-handle fracture of the medial meniscus showing a smooth, thick, bluntly rounded central margin slightly grooved in its posterior two thirds. There is a narrow anterior strip of capsular fragment.

Fig. 43. Under surface of the specimen showing a flat fracture surface produced by the complete central rotation of the inferior lip of the original deep peripheral fracture groove.

CASE NO. 27. British Male, age 25, September 1925.

HISTORY: He first injured his left knee in January 1925 at football. The knee locked and later swelled up. A week ago, at football, he put out the knee for the second time.

SIGNS and SYMPTOMS: Movements of the knee are complete. Slight joint effusion. Tenderness localised to the anterior end of the medial joint line. Skiagrams negative.

OPERATION: October 1925. R.J. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its anterior and posterior attachments through 180° into the central joint area. The dislocated fragment was excised.

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital three weeks after operation with normal function. Not traced.

SPECIMEN: Fig. 44. Upper surface of the central fragment of a bucket-handle fracture of the medial meniscus. There is a transverse fracture of the central margin of the meniscus near the junction of its middle and posterior thirds; and this margin is thickened by the complete central rotation of the inferior lip of the original peripheral fracture groove.

CASE NO. 28. British Male, age 23, July 1925.

HISTORY: He put out his left knee for the first time at football in December 1924. Last night he put out the knee for the third time while playing tennis. He managed to push the knee straight, but on awaking this morning he found he could not straighten it.

SIGNS and SYMPTOMS: Movements of the knee are complete. Moderate joint effusion. Tenderness localised over the anterior half of the medial joint line. He was given the usual conservative treatment in hospital and in due course discharged to duty. In February 1926 he put out the knee for the fourth time as he was marching on guard duty.

OPERATION/

OPERATION: February 1926. R.J. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its anterior and posterior attachments through 180° into the central joint area. The dislocated fragment was excised.

CONVALESCENCE: Uneventful.

RESULT: December 1927. He has done full duty, played games regularly and had no further trouble with the knee since the operation until two days ago when he was kicked on the left knee at football and had to be admitted to hospital the next day with an acute synovial effusion into the joint. This responded quickly to the usual treatment.

SPECIMEN: Fig. 45. The under surface of the central fragment of a bucket-handle fracture of the medial meniscus, showing a deeply grooved fracture along the greater part of the length of its peripheral border; the groove has been opened out by the complete central rotation of its inferior lip.

CASE NO. 29. Indian Male, age 27, October 1928.

HISTORY: In 1921 he fell into a ditch at night and injured his left knee for the first time. He was treated in hospital for two months. The knee has given him trouble on and off ever since, being

liable/

liable to swell up on slight provocation. As he is a bandsman he has been able to carry out his duties up to date.

SIGNS and SYMPTOMS: Movements of the knee are complete except for some limitation of full flexion. No joint effusion. Acute tenderness localised to the anterior end of the medial joint line. Marked atrophy and atony of the left Vastus medialis muscle. Skiagrams negative.

OPERATION: November 1928. T.F. incision, antero-medial arthrotomy. Complete bucket-handle fracture-dislocation of the medial meniscus found. The dislocated fragment appeared to be rotated on its anterior and posterior attachments through 180° into the central joint area. Excision of the medial meniscus performed.

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital with normal function. Not traced.

SPECIMEN: Fig. 46. Upper surface of a bucket-handle fracture of the medial meniscus. The capsular fragment shows a wedge shaped fracture margin; the central fragment has a thin peripheral margin and a thick grooved central margin.

Fig. 47. Under surface of the specimen showing a broad level fracture surface on the central fragment/

fragment due to the complete central rotation of the inferior lip of the original peripheral fracture groove, with the resulting formation of a secondary shallow, smooth surfaced groove along the central border of the meniscus.

CASE NO. 30. British Male, age 22, May 1928.

HISTORY: In September 1924, at football, he received a kick on the front of his right knee. He had to stop playing and the knee swelled up. The knee took six months to get right. He had no further trouble until January 1928, when he played a game of rugby football. While in a scrum he was hooking out the ball with his left foot, the right knee being bent, when he felt a sudden pain on the antero-medial aspect of the right knee. He had to limp off the field and then discovered a lump on the front part of the medial joint line of the right knee about the size of a half walnut. Full flexion and extension of the knee were limited by the pain. A tight bandage was applied to the knee and the following day the lump had disappeared, and the knee was swollen. Since then the knee has been out seven or eight times following slight twists such as in turning suddenly to his left or mis-stepping on a loose stone with his right foot; at first swelling of/

of the knee followed on each occasion; latterly no swelling has supervened. On each occasion a "little button of cartilage" protrudes at the front part of the medial joint line and is very tender.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Marked tenderness localised over the middle of the medial joint line. Slight atrophy of the right Vastus medialis muscle. Skiagrams negative.

OPERATION: May 1928. T.F. incision, antero-medial arthrotomy. Inspection and blunt hook detected no lesion of the meniscus. The anterior third of the medial meniscus was freed by dissection and traction on this brought into view a finger like posterior fracture of the meniscus as it dislocated into the central joint area. The excision of the meniscus was completed.

CONVALESCENCE: Uneventful.

RESULT: October 1928. The knee, on examination, appeared quite normal; the patient expressed himself as very pleased with the result of the operation; the knee has given him no further trouble and he requested permission to resume his games, which was granted.

SPECIMEN: Fig. 48. Upper surface of the medial meniscus showing a posterior 'finger' fracture. The anterior central sharp margin of the meniscus changes /

changes at the level of the base of the fracture process into a smooth, blunt margin; the peripheral margin of the process is also smooth and rounded, but considerably thicker than the central margin, and shows a short groove anteriorly at its junction with the body of the meniscus.

Fig. 49. Under surface of the specimen showing the line of excision along the peripheral border of the meniscus including the narrow posterior capsular strip.

COMMENTARY: It is probable that the original lesion in this case was a bucket-handle fracture in the region of the junction of the middle and posterior thirds of the meniscus. Further trauma caused extension of the line of fracture posteriorly; the posterior attachment of the central fragment was then torn through and the fragment moulded into a finger-like mobile process. From time to time, apparently, this process became rotated forwards until its posterior extremity became palpable over the antero-medial joint line. This specimen may be compared with that in fig. 28, where a similar finger fracture would have resulted if the narrow posterior attachment of the central fragment had given way.

CASE NO. 31. British Male, age 31, October 1926.

HISTORY: This patient stated that he first injured his right knee by knocking its inner side against a goal-post at football in September 1922. He was charging the goal and his right knee"went inwards" as it struck the post. Since then he has been in hospital under treatment for the knee on six occasions. He complains of a weak right knee, with limp, occasional locking and recurrent swelling.

SIGNS and SYMPTOMS: Movements of the knee are complete except for some limitation of flexion. No joint effusion. Tenderness is generalised over the medial surface of the knee, the maximum tenderness being sited over the anterior end of the medial joint line. Slight atrophy of the Vastus medialis muscle. Skiagrams negative.

OPERATION: November 1926. T.F. incision, antero-medial arthrotomy. A button of deformed cartilage was found near the anterior extremity of a narrow capsular strip of medial meniscus. The meniscus was excised.

CONVALESCENCE: Uneventful.

RESULT: January 1928. The patient states that the operation has vastly improved his knee. He is doing full duty and rides. He is afraid to play games lest he damage the knee again. The knee has only/

only swollen up once since the operation, due to a fall from his bicycle.

SPECIMEN: Fig. 50. Upper surface of excised medial meniscus. The longitudinal fracture has isolated a long strip of the meniscus, attached in front and free at its posterior extremity. This whip-like fragment has undergone a complete twist in the horizontal plane at its anterior extremity; secondary adhesions have formed at the site of the twist and between the two fragments, which have become completely organised.

Fig. 51. Under surface of the specimen showing line of adhesion between the tail of the central fragment and the capsular fragment.

COMMENTARY: This also was probably originally a bucket-handle fracture, with secondary rupture of the posterior attachment of the central fragment which has then lashed round in the joint until it has assumed this unusual position.

CASE NO. 32. British Male, age 25, May 1926.

HISTORY: He first injured his right knee four years ago at football. The knee did not lock, but swelled up. Ever since then the knee has felt weak; and if he turns to his left on his right foot, the right knee "cricks" with pain at the centre of the medial/

medial joint line. He keeps the knee bent for a few minutes until the pain wears off, after which he can carry on. In August 1924 he was a week in hospital with "water on the right knee" following a game of football, since when he had played very seldom.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Tenderness localised to the centre of the medial joint line. Slight wasting of the right Vastus medialis muscle.

OPERATION: May 1926. T.F. incision, antero-medial arthrotomy. No lesion of the medial meniscus could be detected; when its anterior half had been dissected free and was drawn forwards, a superficial flap fracture of the upper surface of the posterior half of the meniscus became visible. The excision was completed.

CONVALESCENCE: Uneventful.

RESULT: February 1928. The knee has given no more trouble since the operation. The patient states that his knee is "O.K.," and he is playing tennis, hockey and football.

SPECIMEN: Fig. 52. Upper surface of the medial meniscus, showing a peripheral horizontal pedicled fracture of its upper surface in its posterior half. The resulting tag is itself fractured almost completely across about its middle; and, prior to excision, /

excision, the tag was completely bent over on itself at the site of this secondary fracture so that smooth surface was opposed to smooth surface.

COMMENTARY: A rare type of fracture obviously produced by direct violence and occurring at the site of election. It seems probable that at a later stage the distal portion of the fracture flap would have separated and formed a loose body in the joint.

CASE NO. 33. British Male, age 22, March 1926.

HISTORY: He first injured his left knee by falling off a horse in 1923. Since then he has put out the knee eight times.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. Tenderness is localised over the anterior end of the medial joint line and over the femoral origin of the tibial collateral ligament; there is also some slight tenderness over the anterior end of the lateral joint line.

OPERATION: April 1926. T.F. incision, antero-medial arthrotomy. No lesion of the medial meniscus could be detected. The anterior half of the meniscus was dissected free, and the separation carried backwards along its capsular attachment. Traction on the separated portion of meniscus then brought into view an obliquely transverse fracture extending from/

from its central margin almost across its whole breadth to the capsular border, at the junction of its middle and posterior thirds. The anterior segment of the meniscus was removed.

CONVALESCENCE: Uneventful.

RESULT: January 1928. He is doing full duty and rides; but he has given up football owing to a tendency to swelling of the knee after such exercise.

SPECIMEN: Fig. 53. Upper surface of anterior two thirds of the medial meniscus, separated from its posterior third by an obliquely transverse line of fracture.

CASE NO. 34. British Male, age 33, August 1927.

HISTORY: This patient, an officer, originally injured his left knee while playing rugby football in 1921. He was running straight to his front and thinks he mis-stepped in a dip in the ground. His left knee suddenly gave way under him; it "went inwards". He fell with sickening pain on both sides of the knee. The knee locked in flexion, and was straightened on the spot by a vigorous pull. The knee swelled up. He was carried off to hospital where he remained for six weeks. After some leave he returned to duty, but the knee felt weak and was apt to "give slightly, as if the bones of the joint slipped on each other." He refrained from games and/

and violent exercise for eight months. Thereafter he came out to India and has wrenched the knee at games two or three times a year ever since, in spite of a knee bandage which he always wears. When he thus wrenches the knee the pain is sickeningly severe on both sides of the joint and gets no less on each successive occasion. The knee swells up. He lies up for four days and applies antiphlogistine to the joint, and is then able to carry on. He has discovered that if he takes care not to extend the knee completely he gets on very well, there is no "slipping" and the knee feels secure. But if the knee is quite straight and he turns on his left foot, especially if he turns to his right, he feels the knee slip, but has no pain unless the strain or wrench is severe. The last occasion on which he strained the knee was in June 1927 when, playing tennis, he jumped off the ground and landed on his left foot with the knee extended. He fell with intense pain on both sides of the joint, which lasted five minutes and was, perhaps, worse on the medial side.

SIGNS and SYMPTOMS: Movements of the knee were complete. No joint effusion. Slight tenderness localised over the anterior end of the medial joint line. Slight wasting of the muscles of the distal left thigh. Palpation of the joint during active movement/

movement elicited a fine crepitant sensation, which was not present in the right knee. There is a slight excessive side to side mobility at the left knee-joint suggestive of lax ligaments due to over-stretching by repeated joint effusions. The gait is normal. Skiagrams are negative. Operation was postponed until the advent of cooler weather. He had one more attack of synovitis of the knee.
On January 23rd, 1928 he was descending a hill and landed heavily on his left foot with the knee straight. He fell "like a shot rabbit". When seen two days later there was a slight effusion present in the left knee; movements were unrestricted; tenderness was localised to the medial joint line just anterior to its middle point, and also over the medial surface of the medial condyle of the tibia.

OPERATION: April 1928. T.F. incision, antero-medial arthrotomy. The medial meniscus presented no abnormal mobility; and just within the range of vision, about its middle, an indication of some lesion was detected in an irregularity of its surface. The meniscus was excised in two portions which were connected by a narrow capsular strand of tissue which gave way during the excision when traction was made on the anterior fragment. A patch of fibrillated degeneration was noted on the carti-

lage/

cartilage of the anterior portion of the medial femoral condyle.

CONVALESCENCE: Uneventful.

RESULT: November 1928. He has had no further trouble with the knee except for a "click" which occurs at intervals when he is walking, not associated, however, with any pain or discomfort. He rides and swims and plays tennis without any trouble. On examination the joint appears normal, except that now and then when he walks it gives an audible muffled "click" accompanied by a jerking forward movement of the medial femoral condyle on the tibia. There is no pain or tenderness. The clicking seems to be getting less as time goes on.

SPECIMEN: Fig. 54. Upper surface of the medial meniscus separated into two portions by an obliquely transverse fracture in the region of the junction of its middle and posterior thirds. The posterior portion of the anterior fragment has become bent over on itself so that its inferior surface looks upwards and presents a flat surface bounded by a semicircular rim which represents the original sharp, free margin of the meniscus. The original upper surface of this portion is bulged into a convex dome-shaped area which has contracted organised adhesion to the adjacent upper surface of the anterior fragment.

Fig, 55/

Fig. 55. Under surface of the specimen.

COMMENTARY: The absence of locking, except on the occasion of the original injury, the absence of any amelioration of symptoms in succeeding attacks, and the agonising pain following compression strain on the extended knee can all be correlated with the presence of this thick, button-like deformation of the meniscus.

CASE No. 35. British Male, age 20, January 1929.

HISTORY: Four years ago he was chasing a runaway horse and in jumping down a bank he twisted his left knee and fell with pain on the medial side of the joint. The knee swelled up. He was treated in hospital for a month and diagnosed "cracked knee cartilage". Since then the knee has been weak and has gone out repeatedly whenever he has twisted it at games, swimming, or even walking. Six weeks ago for the first time he noticed a small bean-like lump on the antero-lateral joint line whenever the knee went out. The swelling of the joint which follows on these occasions is getting gradually less pronounced. He last put out the knee on December 25th. 1928 while kicking about a football.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No tenderness. No muscular atrophy or atony. Skiagrams negative.

OPERATION: January 1929. T.F. incision, antero-lateral arthrotomy. Complete bucket-handle fracture-dislocation of the lateral meniscus found. There was no appearance of rotation of the dislocated fragment. Total excision of the meniscus.

CONVALESCENCE: Uneventful except for a relapse of malarial fever.

RESULT: Discharged from hospital with normal function. Not traced.

SPECIMEN: Fig. 56. Upper surface of a bucket-handle fracture of the lateral meniscus. The anterior halves of the fractured margins of both fragments are deeply grooved, the grooves interlocking when brought into apposition. The posterior halves of these margins present a clean cut vertical split. Anteriorly the central fragment is doubled forwards, with secondary thickening at the re-entrant angle.

Fig. 57. Post-operative temperature chart.

CASE NO. 36. British Male, age 24, February 1929.

HISTORY: About a year ago he was kicked at football on the antero-medial aspect of the left knee, just below the knee-cap. The knee swelled up, but got well within a few days; and he had no further trouble until three months ago, when he began to notice/

notice a "clicking" in the knee and a liability of the knee to give way under him, resulting in his falling to the ground.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No local tenderness. No muscular atrophy or atony. Active extension of the knee produces a muffled snapping sound on the lateral side of the joint, combined with a fine crepitant sensation on palpation of the antero-lateral joint line. Skiagrams negative.

OPERATION: February 1929. R.J. incision, antero-lateral arthrotomy. A fracture-dislocation of the lateral meniscus was found, the fracture line extending forwards as far as the junction of the middle and anterior thirds of the meniscus. No apparent rotation of the dislocated fragment. Excision of the anterior third and the dislocated fragment of the meniscus performed. The anterior end of a large portion of separated articular cartilage of the lateral femoral condyle now presented. A pair of curved scissors introduced between this and the femoral condyle encountered a gritty soft pedicle of posterior attachment between the condyle and the loose fragment; this was snipped through and the loose body removed. A corresponding saucer-like area was found on the femoral condyle with a floor formed by cancellous bone.

CONVALESCENCE:/

CONVALESCENCE: Uneventful. Post-operative skiagrams negative.

RESULT: Discharged from hospital with normal function. The knee no longer produced a 'click' or crepitant sensation. Not traced.

SPECIMEN: Fig. 58. Upper surface of a bucket-handle fracture of the lateral meniscus. The peripheral margin of the central fragment shows a plane fracture surface passing from above down and centralward. The anterior end of the central fragment has become squeezed forwards against the anterior third of the meniscus into an acute V-shape, at the angle of which organised adhesions have formed so that the fragments cannot be opened out into their normal position.

Fig. 59. Under surface of the specimen.

Fig. 60. Articular surface of detached fragment of the femoral condyle.

Fig. 61. Under surface of detached fragment, showing yellowish cancellous bony core surrounded by thick, fractured margin of articular cartilage.

COMMENTARY: In case 35 it will be noted that pain was referred to the medial side of the joint; in the absence of tenderness when examined, attention was directed to the lateral side of the joint by the patient's observation of the bean-like lump appearing on that side whenever the knee went out.

In/

In case 36 also there was no localising tenderness; but audible and palpable signs were fortunately present to localise the derangement on the lateral side of the joint.

CASE NO. 37. British Male, age 26, March 1927.

HISTORY: On April 27th.1926 he was riding in a gun-team when his horse fell and pinned his right knee to the ground. He was treated in hospital with a back splint to the knee for "synovitis". The knee has been weak ever since and liable to become swollen on slight provocation. If he exposes the knee to any sort of strain "the bones seem to grind together," with pain on the postero-lateral aspect of the joint, and laterally also under the knee-cap. On March 23rd.1927 he was engaged in a tug-o'-war with his right leg advanced, when suddenly the right knee gave way with a cracking sound on its lateral side and acute pain on its postero-lateral aspect. He fell and was unable to straighten the knee.

SIGNS and SYMPTOMS: March 29th.1927. Movements of the knee are complete except for some limitation of full flexion. There is a moderate effusion into the joint. Tenderness localised to the anterior end of the lateral joint line; palpation a little further back on the lateral joint line causes acute pain/

pain referred to the centre of the medial joint line. In walking he limps and does not put the right heel to the ground. He cannot brace back the right knee properly. Skiagrams show a fracture of the medial tubercle of the intercondyloid eminence of the head of the tibia.

OPERATION: April 1927. T.F. long, patella-displacing incision, antero-lateral arthrotomy. No lesion detected in either meniscus. The fractured process was found loosely attached by soft tissue and was excised with scissors.

CONVALESCENCE: Uneventful.

RESULT: December 1927. On examination the knee appeared normal; his gait, however, shows only slight improvement, and he complains of discomfort in the centre of the joint when he braces back the knee. Skiagrams show some bony proliferation in the region of the excised fragment. He was invalided out of the Army unfit for further military service.

SPECIMEN: Fig. 62. Tracing of antero-posterior skiagram of the affected knee prior to operation.

CASE NO. 38. British Male, age 24, November 1928.

HISTORY: The patient complains of an aching discomfort in the right knee of twelve months' duration. There is no history of injury, locking or swelling.

A/

A month ago he was engaged in turning head over heels, and at the end of one such manoeuvre, as he regained his feet, his right knee locked in flexion with severe pain in the antero-lateral region of the joint and in the suprapatellar region. The knee did not swell up and gradually straightened during the course of the following fortnight, but not completely. Lately he has discovered a "small piece of bone" which appears on the lateral side of the knee occasionally during flexion movements of that joint; when he presses on this "bone" it slips away under the knee-cap.

SIGNS and SYMPTOMS: There is slight limitation in full extension and full flexion of the knee. No joint effusion. No tenderness. Muscular tone and nutrition normal. As he sat down to pull on his boots the loose body appeared and was palpated on the lateral side of the suprapatellar pouch. An antero-posterior skiagram of the joint was negative; but the lateral view demonstrated the presence of the loose body.

OPERATION: December 1928. T.F. incision, antero-lateral arthrotomy. No lesion of the lateral meniscus was detected; nor was any defect in the articular surfaces of the joint seen. A loose body was found lying on the medial side of the patellar synovial fold whence it was extracted.

CONVALESCENCE/

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital with normal function. Not traced.

SPECIMEN: Fig. 63. The two surfaces of a loose body measuring 1.7 c.m. long, 1.1 c.m. broad, and 0.7 c.m. thick, consisting of a yellowish calcified layer surmounted by a thick slab of white cartilage.

Fig. 64. Lateral view of the loose body showing the smooth surface of the cartilage and its faintly striated marginal fracture rim.

Fig. 65. Tracing of a lateral skiagram of the knee prior to operation showing well marked shadow of the loose body at the apex of the patella.

CASE NO. 39. Indian Male, age 35, November 1927.

HISTORY: In February 1925 he fell during a night operation and twisted his right knee. He was under treatment in hospital for two months. The knee gave no further trouble until a few days ago when, as he was running, he fell and sprained the right knee again.

SIGNS and SYMPTOMS: There is no limitation of extension of the knee; but flexion is limited to 90°. There is a moderate effusion into the joint. Tenderness is present over the anterior half of the medial joint line and over the tibial attachment of the/

the tibial collateral ligament of the knee; also over the anterior half of the lateral joint line and the fibular attachment of the fibular collateral ligament. The actively moving joint yields to palpation a fine crepitant sensation. Skiagrams show lipping of the margins of the tibial articular surface of the knee-joint and the presence of some six or seven small loose bodies in the posterior synovial recesses.

OPERATION: January 1928. Short vertical incision, postero-medial arthrotomy. Two small, soft, white fibro-cartilaginous loose bodies extracted from the semimembranosus bursal sac which communicated with the joint; exploration of the adjacent joint cavity was negative.

CONVALESCENCE: Uneventful.

RESULT: The patient returned to full duty six weeks after the operation and did not report sick again in the course of the following twelve months, after which he was not traced.

SPECIMEN: Fig. 66. Shows the size and appearance of the loose bodies extracted.

Fig 67. Tracing of a lateral skiagram of the knee prior to operation.

COMMENTARY: The condition is probably that of multiple synovial chondromata, some, at least, of which have become detached and found their way into a synovial diverticulum.

CASE NO. 40. Indian Male, age 20, March 1928.

HISTORY: On March 13th.1928 he was kicked by a mule on the front of his right knee. When examined two days later the knee was found to be swollen and painful, its movements limited, and there was an abrasion over the centre of the proximal border of the patella. The joint was aspirated and one ounce of blood-stained synovial fluid was withdrawn. Skiagrams showed a streaky shadow in the joint space between femur and tibia. The patient post-poned operation until after a period of leave. He reported again in August 1928 with a joint free from effusion. His gait was limping; and full flexion and extension of the knee were limited. Skiagrams showed that the shadow had altered from a streaky to a mottled character, and had moved from the joint interspace to the suprapatellar pouch. No loose body was palpable.

OPERATION: August 1928. Short, mesial suprapatellar incision. The subjacent synovial pouch was incised and the loose body extracted.

CONVALESCENCE: Uneventful.

RESULT: Owing to a persistent limp due to insufficient co-operation on the part of the patient, this man had to be invalided out of the Army. On examina-tion the joint appeared perfectly normal.

SPECIMEN: Fig. 68. Shows the smooth convex and uneven concave aspects of a typical almond shaped solitary loose body. In the fresh specimen there was no visible or palpable evidence of bone or calcium deposits.

Fig. 69 shows the dessicated specimen in which the cartilaginous matrix has dried into a thin, brown, translucent flake on which the white calcareous islets stand out prominently.

Fig. 70. Tracings of a lateral skiagram of the knee taken on March 16th. 1928, showing the streaky shadow of the loose body as it lies horizontally in the anterior compartment of the joint. A defect in the outline of the lateral condyle of the femur is very evident.

Fig. 71. A positive print of a lateral skiagram of the knee taken on July 14th. 1928, showing the shadow of the loose body as it lies vertically, edgeways to the femur, in the superior compartment of the joint.

COMMENTARY: A lateral skiagram of the knee taken in October 1928 shows the same defect in the outline of the lateral condyle of the femur. It has been written that the origin of these bodies is one of the most debated questions in surgical pathology. "They obviously consist of a portion of the articular surface of one of the bones, but how this/

this is detached still remains a mystery; some maintain that it is purely traumatic; König regards them as portions of the articular surface which have been detached by a morbid process which he calls 'osteo-chondritis dessicans'." [17]

CASE NO. 41. British Male, age 24, November 1926.

HISTORY: Two years ago, while playing football he found his left knee beginning to be painful; by the end of the game the knee was swollen. Since then the knee has suffered from recurrent effusions. He first discovered a loose body when palpating the knee in March 1926 after he had "ricked" the knee while running.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No tenderness; but he complains of pain over the lateral side of the knee. A loose body is palpable in the suprapatellar pouch. So long as the body remains in this pouch the knee gives no trouble; but, if it disappears distally into the joint, the knee is liable to lock in flexion with acute generalised pain. Skiagrams show in the antero-posterior view one large loose body lying in the centre of the joint space; and in the lateral view a second small loose body lying over the proximal border of the patella.

OPERATION./

OPERATION: November 1926. T.F. incision, antero-medial arthrotomy; the incision was extended proximally into the superior joint compartment from which one large and two small loose bodies were extracted. No lesion of the medial meniscus or of the adjacent articular surfaces was detected.

CONVALESCENCE: Uneventful except for a relapse of malarial fever.

RESULT: January 1927. The knee has given no further trouble, although he still feels that it is weak. The joint appears normal on examination.

SPECIMEN: Fig. 72. Shows the two surfaces of the large loose body.

Fig. 73. Shows the two small loose bodies.

CASE NO. 42. British Male, age 26, May 1927.

HISTORY: During the last six years his left knee has frequently given him trouble by giving way and locking in flexion. There is no history of any trauma. He first discovered a loose body by palpation about 3½ years ago. During the last six months the knee has locked with increasing frequency up to five or six times a day. The locking may occur at any time irrespective of what he may be doing.

SIGNS/

SIGNS and SYMPTOMS: Extension of the knee is complete; flexion is limited. No joint effusion. No tenderness. A loose body about the size of an almond is palpable in the suprapatellar pouch. This could be pushed down alongside the lateral border of the patella until it disappeared into the joint, when the knee locked forthwith. After some massage and manipulation of the knee, the body reappeared proximal to the patella and the locking was relieved. Skiagrams confirmed the diagnosis.

OPERATION: June 1927. Short, vertical, mesial suprapatellar incision. Loose body extracted from the suprapatellar pouch.

CONVALESCENCE: Uneventful.

RESULT: December 1927. He is doing full duty, playing games, and has had no further trouble with the knee.

SPECIMEN: Fig. 74. The two surfaces of the loose body showing smooth yellowish cartilaginous body encrusted over more than half its surface area with a hard white calcareous coating.

Fig. 75. Tracing of a lateral skiagram of the knee prior to operation, showing the loose body outlined just proximal to the patella. The heavy calcareous envelope gave an excellent shadow in this case.

CASE NO. 43. British Male, age 22, January 21st. 1929.

HISTORY: Three years ago, while jumping, he "knocked his left knee-cap out of place". The knee was locked by a lateral dislocation of the patella, which was reduced in hospital, where he remained for six weeks. Ever since then the knee has swollen up about once a month, without any apparent cause, accompanied by pain along the lateral margin of the patella. Apart from the original occasion there has been no locking of the joint. The swelling subsides with rest. Whenever he runs the knee seems "to give under him with a painful click." Two days ago after jumping, he noticed for the first time two hard lumps alongside the lateral border of the patella.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No tenderness. Two loose bodies are palpable alongside the lateral border of the patella, and can be manipulated round the proximal border of the patella to its medial side. Skiagrams confirmed the diagnosis.

OPERATION: January 25th. 1929. Short, vertical supero-lateral incision. Two loose bodies extracted from the superior compartment of the joint.

CONVALESCENCE: Eneventful.

RESULT: Discharged from hospital with normal function. Not traced.

SPECIMEN: Figs. 76, 77. Show the smooth convex and uneven concave surfaces of two typical white cartilaginous loose bodies. The fresh specimens presented no naked-eye or palpable evidence of bony or calcareous deposits.

Fig. 78. Tracing of a lateral skiagram of the knee prior to operation, showing well defined shadows of two loose bodies lying just proximal to the patella. There is a marked defect in the outline of the lateral condyle of the femur in the region of the patellar shadow, obviously due to some loss of substance.

CASE NO. 44. British Male, age 23, March 1929.

HISTORY: This patient, a ship's officer, received an accidental blow from a rope-end over the front of his left knee five years ago. The knee went out; but after a few minutes went back with a jerk. No swelling supervened. He had no further trouble with the knee until November 1928, when one day he was tying his right shoe lace with his left leg lying extended on a table in front of him; the left knee suddenly seemed to give way and the joint swelled up. He received treatment in hospital for 54 days. He first discovered the presence of a loose body in the knee by palpation in January 1929.

The/

The knee feels insecure; and he has not risked playing games for the last five years.

SIGNS and SYMPTOMS: Movements of the knee are complete. No joint effusion. No pain or tenderness. During active movements of the knee there occurs occasionally a muffled clicking sound. The loose body becomes palpable now and then on the medial side of the apex of the patella. Skiagrams negative.

OPERATION: March 1929. T.F. incision, antero-medial arthrotomy. Loose body found lying in front of the anterior part of the intercondylar articular surface of the femur, behind the patella, whence it was extracted. No lesion of the medial meniscus was detected, nor any defect in the adjacent articular surfaces.

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital with normal function. Not traced.

SPECIMEN: Fig. 79. Shows the two surfaces of the loose body which is of rather an unusual shape; one surface smooth, white, glistening and convex, marked with a series of fine radiating grooves; the other surface uneven and concave. In the fresh specimen there was no naked-eye or palpable evidence of bony or calcareous deposits.

CASE NO. 45./

CASE NO. 45. British Male, age 24, December 1927.

HISTORY: He injured his right knee a few days ago at football. He jumped up for the ball and landed on his feet with knees extended. The right knee gave way under him and he fell.

SIGNS and SYMPTOMS: Extension of the knee limited. Joint effusion present. Tenderness localised at the posterior end of the medial joint line. Skiagrams negative.

OPERATION: January 1928. R.J. incision, antero-medial arthrotomy. A small fibrinous 'melon-seed' flake floated out in excess of synovial fluid. A pedicled fringe containing two soft fibrinous bodies excised from the medial alar fold. No lesion of the medial meniscus detected.

CONVALESCENCE: Uneventful.

RESULT: October 1928. He has had no further trouble with the knee; does full duty; plays games. Knee-joint normal on examination.

SPECIMEN: Fig. 80. 'Melon-seed' loose body and synovial pedicled loose body.

COMMENTARY: The 'melon-seed' body belongs to the class of fibrinous loose bodies (corpora oryzoidea) which are found in cases of tuberculosis, arthritis deformans and Charcot's disease. Although they are usually present in large numbers, they may occasion-

ally/

occasionally be solitary. They are said to be due to coagulation of fibrin forming elements in the synovial exudate, or to coagulation necrosis or fibrinous degeneration of the surface layer of a diseased synovial membrane.[17] The pedicled body is derived from erratic overgrowth of a fringe of synovial membrane. The pedicle tends to give way and a wandering loose body is then set free in the joint, which is capable of growth, obtaining nourishment from the surrounding synovial fluid. This is the same patient as Case No. 55 , who had previously had an operation on his left knee.

CASE NO. 46. British Male, age 27, December 1926.

HISTORY: In April 1924, when boxing he twisted the right knee as he stooped to dodge a blow and the knee went out. Operation was performed in December 1924, and the medial meniscus was excised. For two months after his discharge from hospital the knee gave no trouble, but thereafter it has gone out repeatedly, the last occasion being six weeks ago. The knee goes out at the slightest twist, frequently as he walks and once even in his sleep. It locks in flexion with a sharp pain in the region of the anterior extremity of the medial joint line, followed by joint effusion. He massages the knee, which/

which gradually straightens with subsidence of the effusion after about a fortnight.

SIGNS and SYMPTOMS: Sound scar of former R.J. incision for antero-medial arthrotomy. Movements of the knee complete. No joint effusion. No muscular wasting. No pain or tenderness. It was thought that possibly the operator had failed to detect any lesion in the meniscus and had closed the joint without excising the meniscus.

OPERATION: December 1926. T.F. incision, antero-medial arthrotomy. Anterior half of narrow capsular remnant of the medial meniscus excised. A small white, firm, rounded, smooth body presented in the central joint space which was found to be attached by a thin, flat, translucent pedicle posteriorly so that it could not be drawn very far forward. The pedicle was divided with scissors and the body removed.

CONVALESCENCE: Uneventful.

RESULT: Discharged from hospital with normal function. Not traced.

SPECIMEN: Fig. 81. Pedicled loose body probably derived from the posterior extremity of the medial meniscus.

CASES 47 to 65.

Summaries of these cases are not given as their histories etc., more or less parallel those given above. In each case the operation was undertaken in the expectation of finding a damaged meniscus, and in each case no damage could be detected through the anterior incision. An incidence of negative knee-joint explorations approaching thirty per cent may seem excessive; but, judging from the history and clinical features, it would be difficult to deny the indication for operation in any individual case. An error, however, may quite well lie in a lack of boldness in proceeding to the excision of the suspected structure in more of these cases. In five of them, where the clinical picture appeared typical in every respect, the medial meniscus was excised and found to present no abnormality. The memory of the excision of a normal meniscus in several cases tended to restrict the scope of the exploration in other cases. In a few instances what appeared to be abnormally thickened, hypertrophied or redundant synovial fringes were excised. While the simple exploratory operation appears to have benefitted many of these patients, even to the point of cure, so far as they could be traced, in no case could any aggravation of previous symptoms/

symptoms be attributed to the proceeding. A certain number may come to a second operation with a more definitely diagnosable pathology.

VI. SOME REMARKS ON THE PATHOLOGY OF CERTAIN LESIONS OF THE MENISCI OF THE KNEE-JOINT.

It will be seen that out of 36 demonstrable lesions of the menisci of the knee-joint 31, i.e. 86 per cent, were bucket-handle fractures. If the two additional cases 30 and 31 are included amongst bucket-handle lesions the percentage rises to nearly 92. This is in accordance with the findings of A.M. Martin out of his extensive experience. I have elsewhere[18] drawn attention to the misleading appearance of rotation of the central fragment of a bucket-handle fracture-dislocation of a meniscus which is presented to the surgeon in certain cases when he opens the joint. So far I have met with this appearance only in lesions of the medial meniscus. Cases 20 to 29 illustrate this condition in some of its various phases. Timbrell Fisher[4] comments on this appearance as follows:

"The portion of the cartilage lying in the notch often has the appearance of being twisted upon itself owing to the fact that the thick portion is in contact with the crucial ligament. This, however, is a pressure effect; the original thin edge of the cartilage relieved from the pressure of the femoral condyle/

condyle undergoes enlargement, and the originally thickened portion becomes flattened."

The condition is shown in plate XI, fig. 18 of his monograph. Martin has also illustrated the condition diagramatically in fig.2 of his paper[1]; but the diagram is apt to be misleading in that it depicts too faithfully the rotation as it appears to exist and not the actual state of affairs. In my opinion, the essential factor in the production of this illusion is the presence of an initial grooved fracture along at least the anterior half of the peripheral border of the central dislocating fragment. When this is present the capsular fragment will be found to show a wedge-shaped fracture along its central margin corresponding to the groove on the central fragment. When the central fragment dislocates into the central joint area it actually does become partly rotated so that its peripheral margin makes contact with the articular surface of the tibia and its groove becomes flattened out by its original inferior lip becoming bent over towards the central area of the joint. Eventually the massaging movements of the femur and tibia approximate this rotated inferior lip to the sharp free margin of the meniscus and the dislocated fragment acquires an appearance the reverse of that originally present; that is to say, it is now a wedge with/

with a thick grooved margin directed towards the centre of the joint and a sharp margin directed towards the joint capsule; it is this appearance that leads one to conclude at first glance that the original central fragment has become completely turned over on its anterior and posterior attachments into the central joint area. Closer examination will reveal that whereas the surfaces of the original fracture groove were the roughened surfaces of a fractured fibro-cartilage, the surfaces of the new formed groove are the normal smooth, glistening surfaces of the meniscus. An endeavour has been made to demonstrate these facts in the cases here reported with their accompanying figures.

VII. CONCLUSIONS.

1. That lesions of the menisci of the knee-joint are of the nature of direct fractures produced by their compression between the condyles of the femur and tibia.

2. That the medial meniscus is far more frequently damaged than the lateral meniscus because the body-weight is more frequently transmitted forcibly via the medial than via the lateral side of the joint.

3. That the site of election of an injury to a meniscus is in the region of the junction of its middle and posterior thirds; and that the lesion most frequently takes the form of a longitudinal fracture producing the familiar bucket-handle appearance.

4. That recurring attacks of synovial effusion into the knee-joint occurring on slight provocation are sometimes accounted for by an internal derangement quite apart from the cases where definite locking of the joint occurs.

5. That the operation for removal of a damaged meniscus can be performed efficiently through a short anterior incision; and, in the great majority/

majority of cases, if the posterior extremity of the meniscus escapes excision it will give rise to no further trouble, provided that the excision has been performed cleanly with knife or scissors and no avulsion has been attempted.

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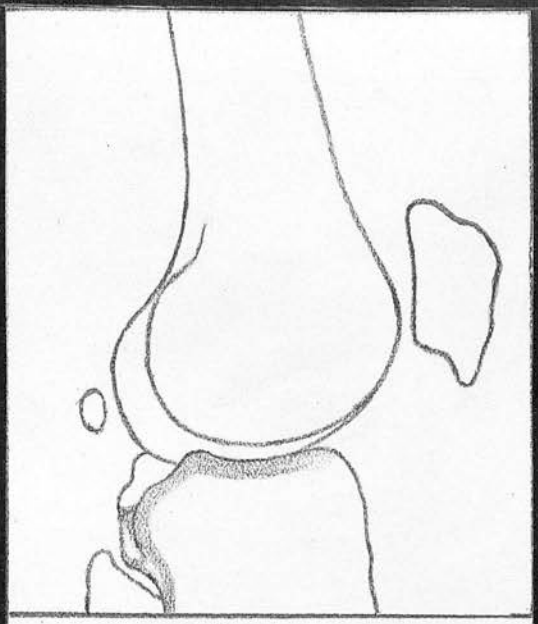

Fig. 1.

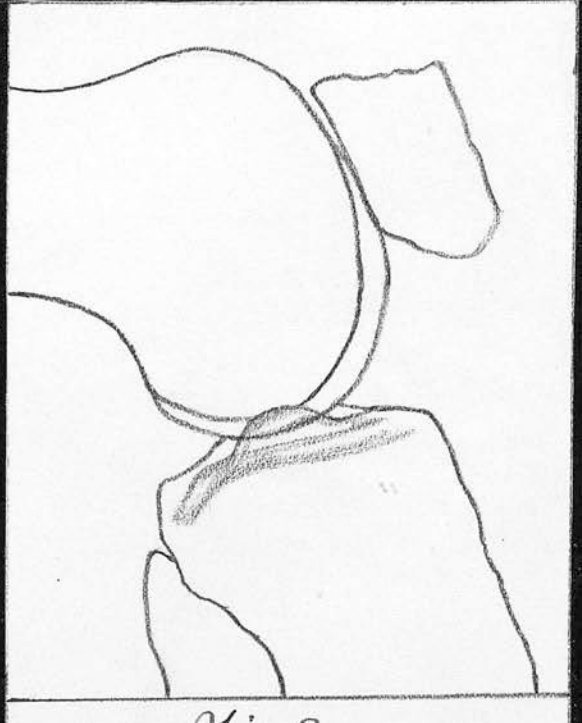

Fig. 2.

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Fig. 4.

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Fig. 12.

Fig. 13.

Fig. 12A.

Fig. 14.

Fig. 15.

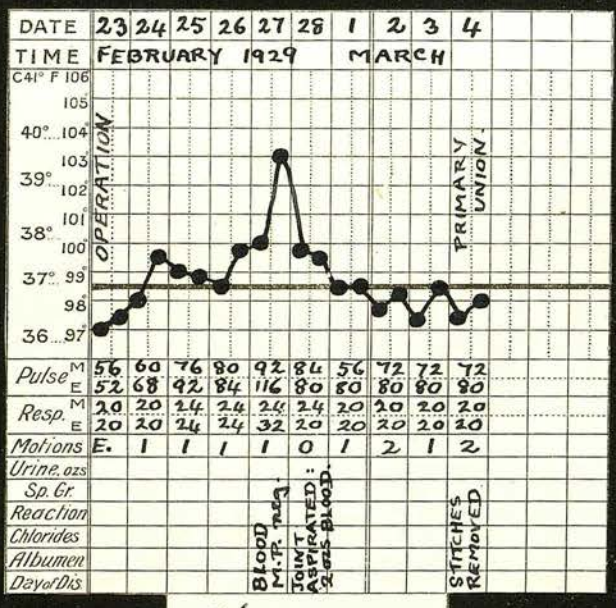

Fig. 16.

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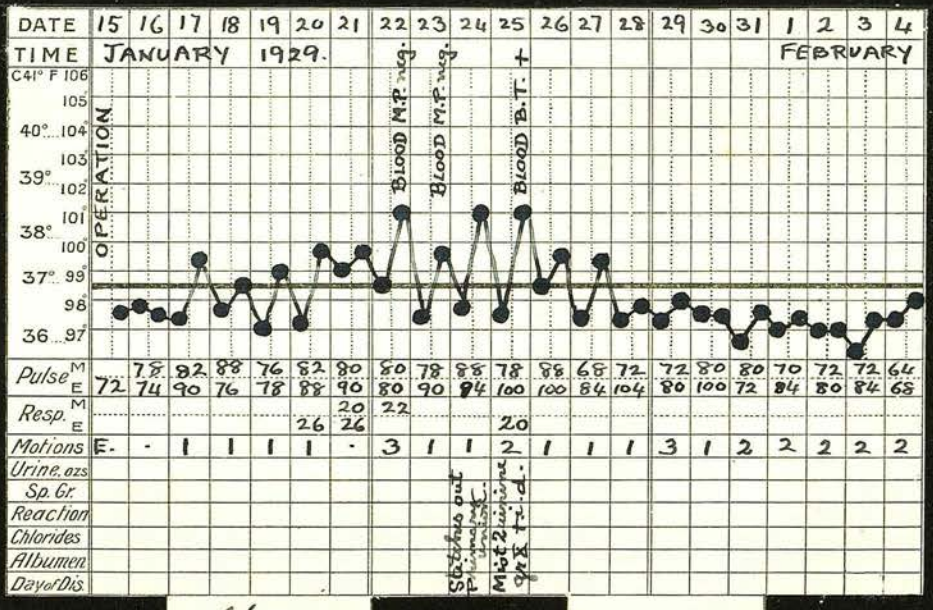
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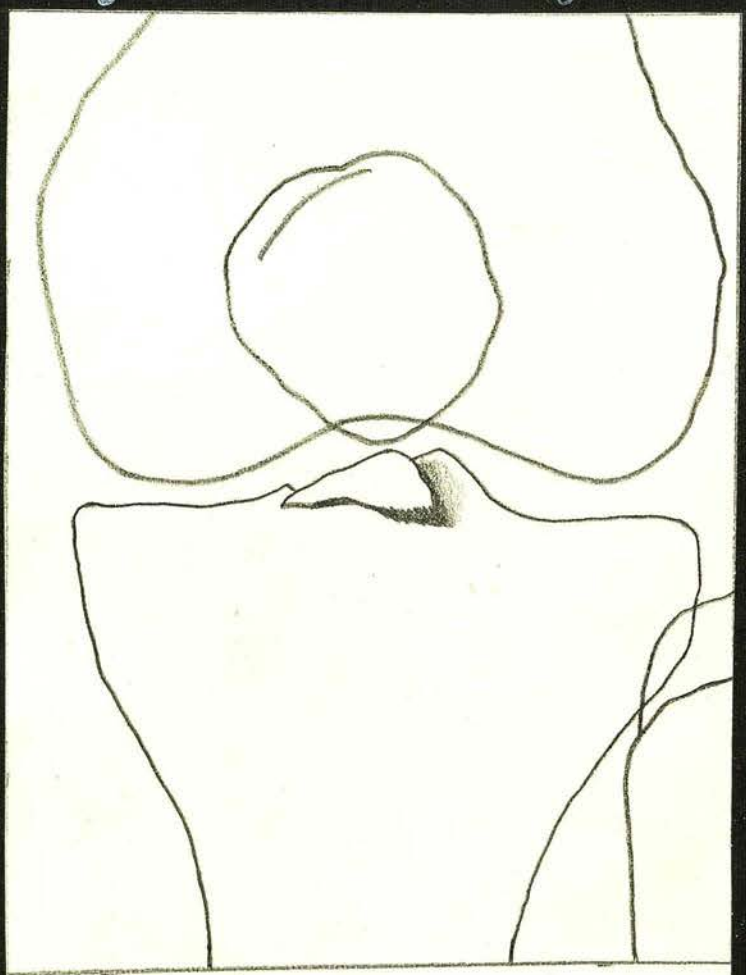

Fig. 62.

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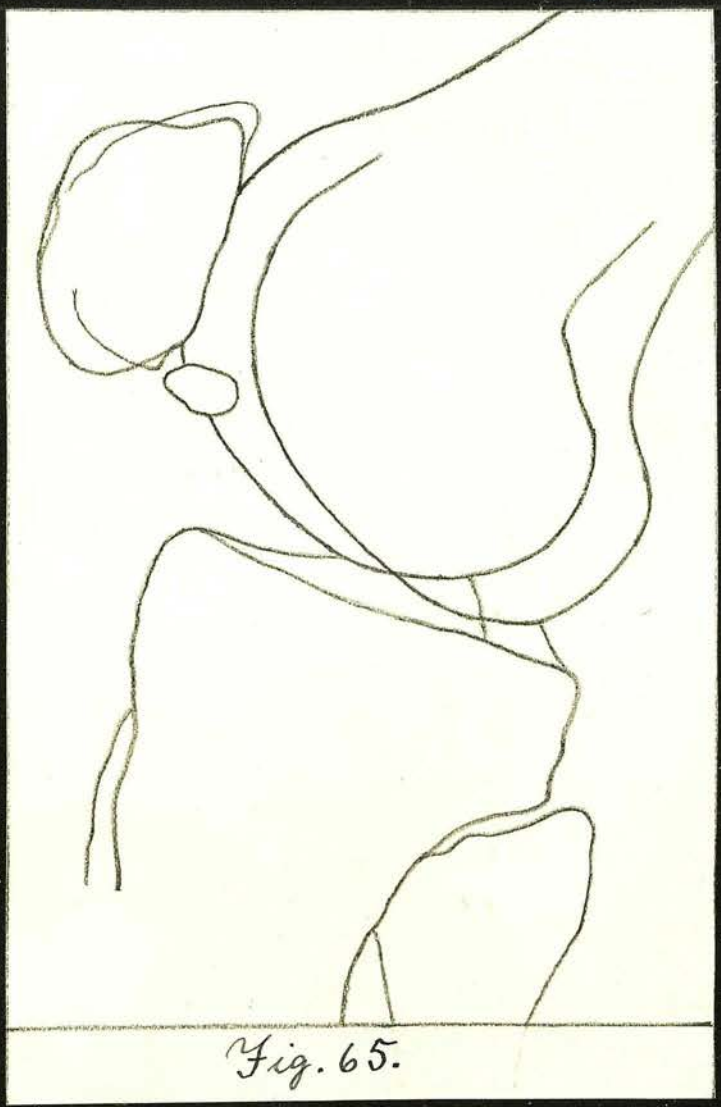

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Fig. 66.

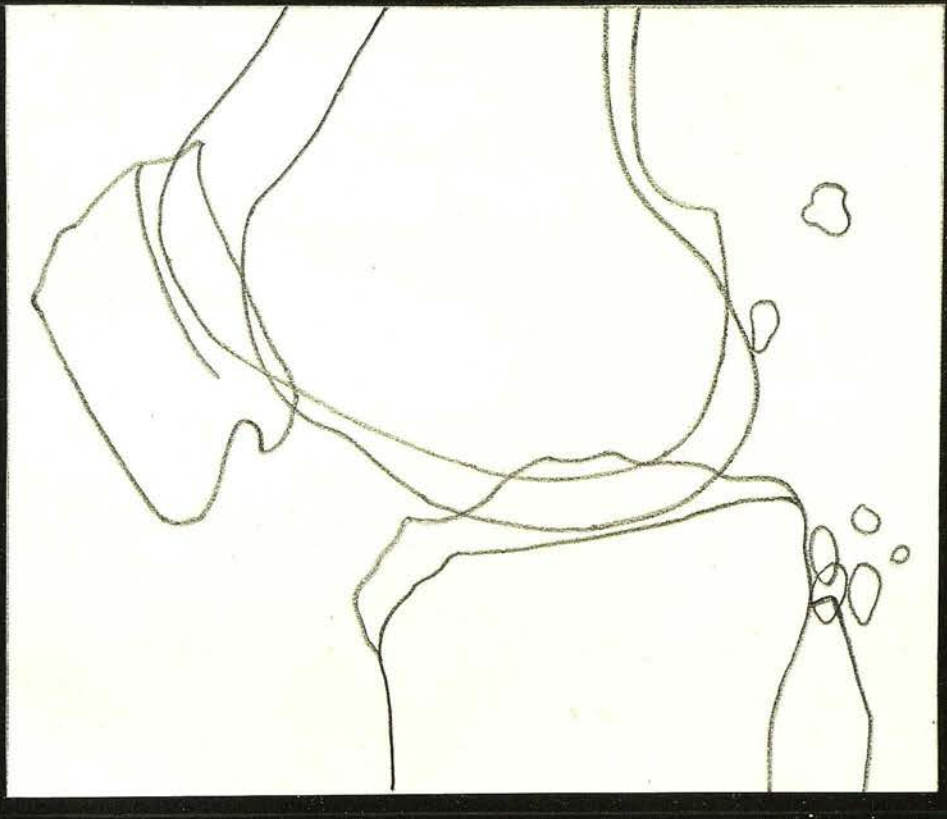

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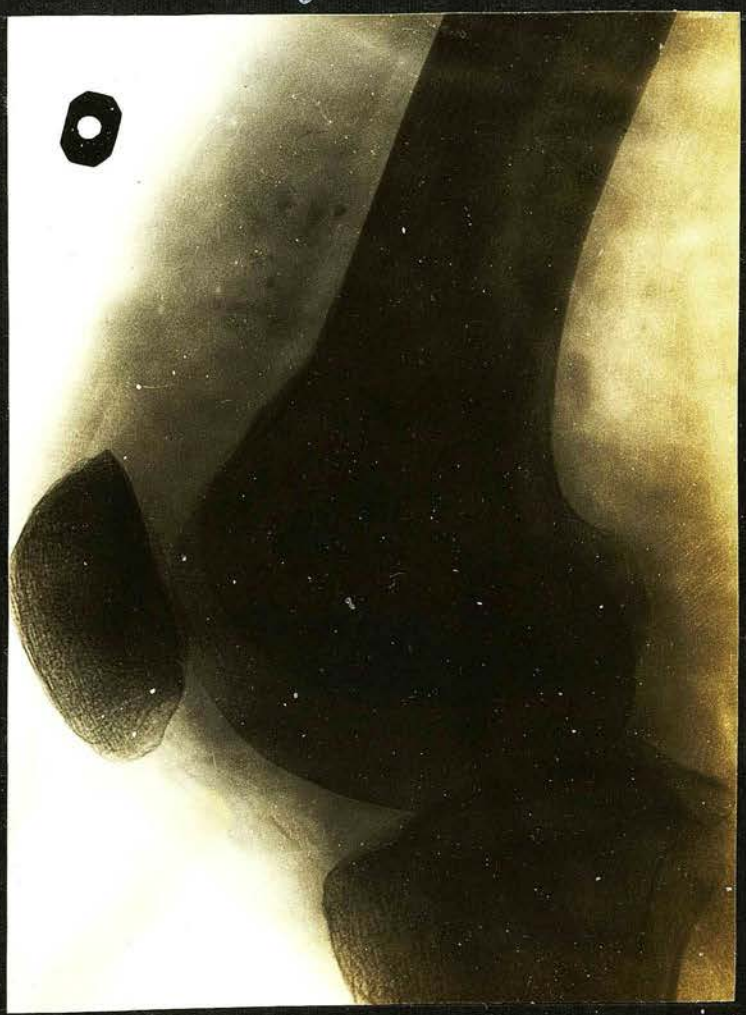
Fig. 68.

Fig. 70.

Fig. 69.



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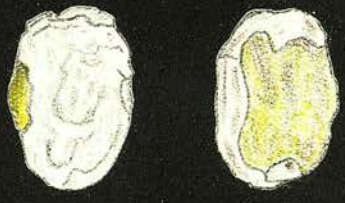

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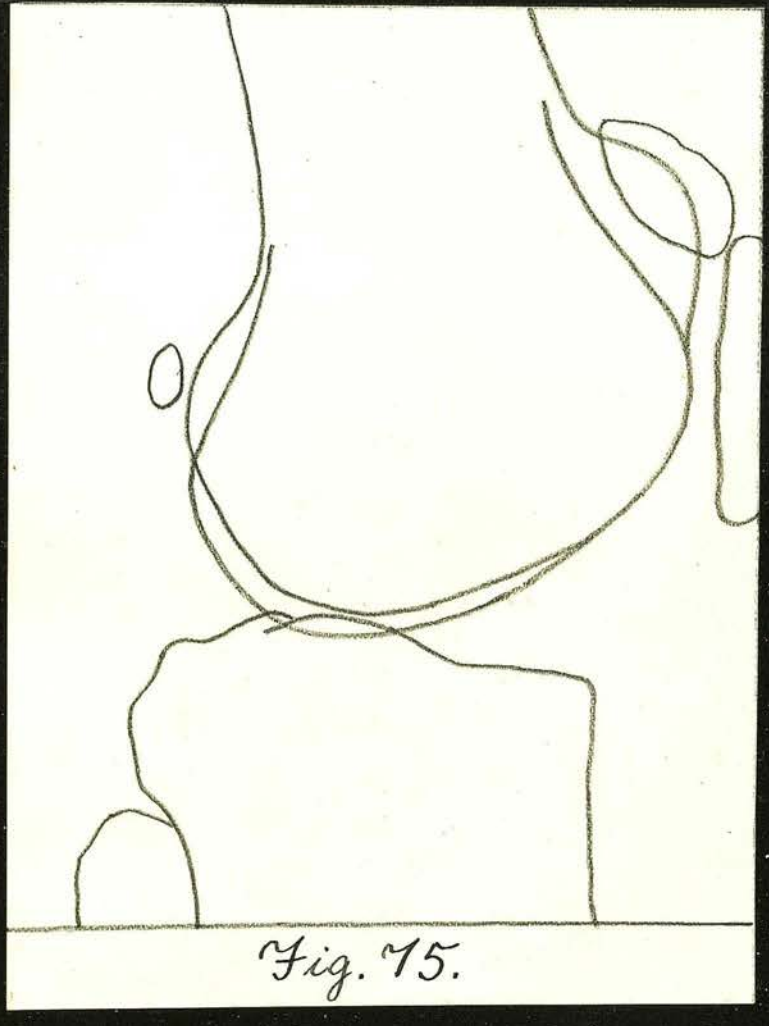

Fig. 75.

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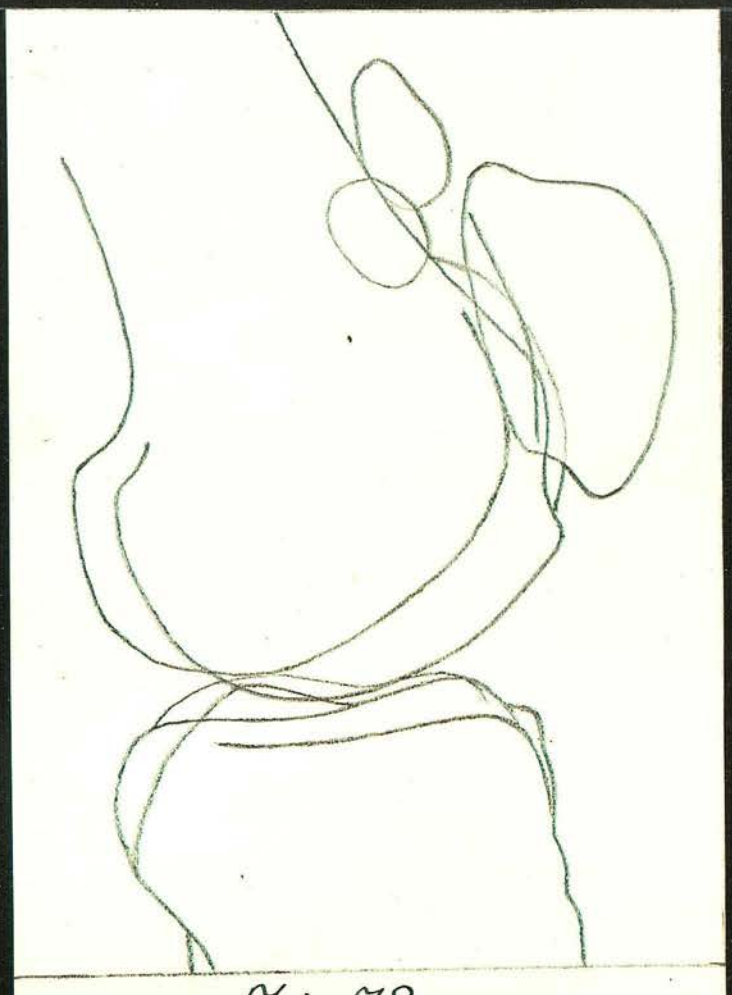

Fig. 78.

Fig. 79.

Fig. 80.

Fig. 81.